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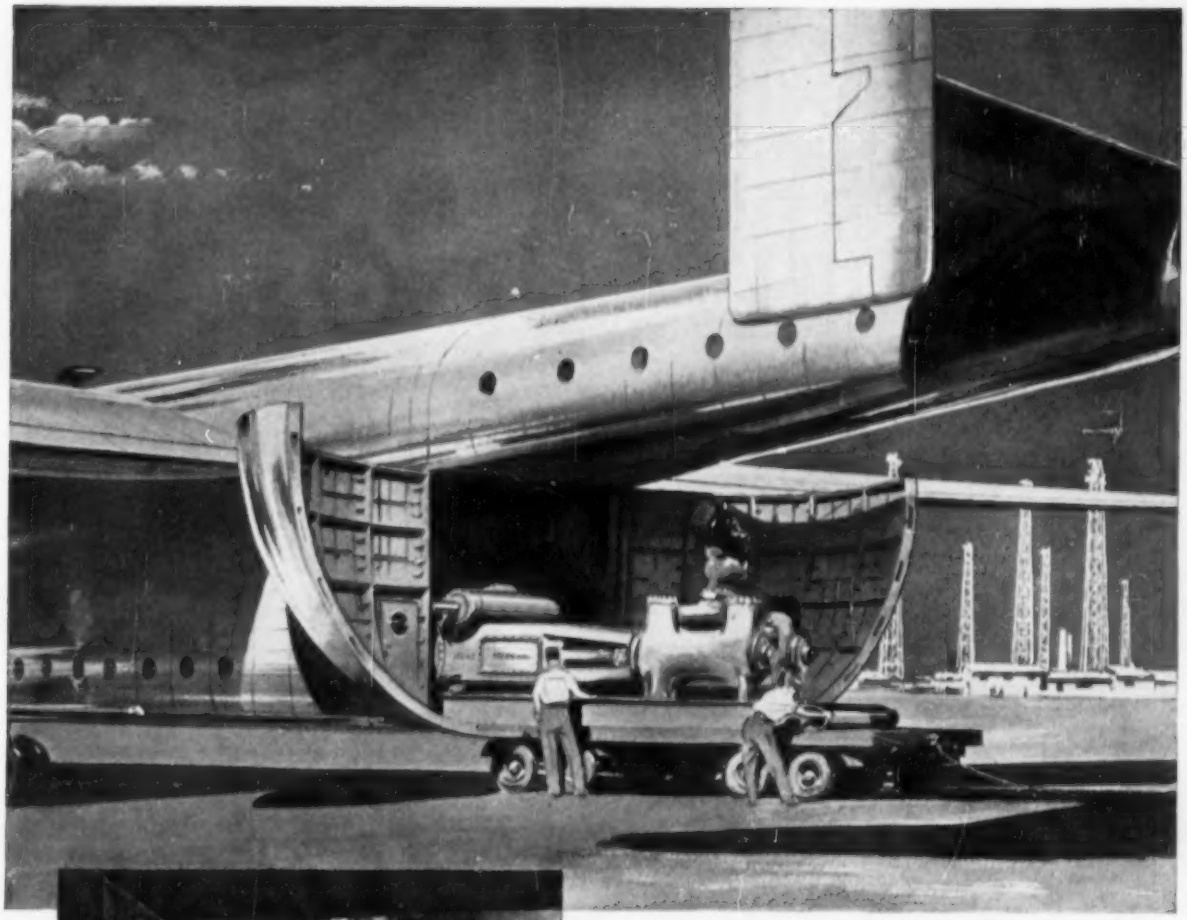

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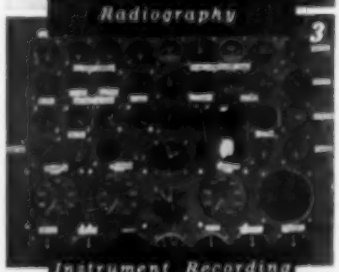


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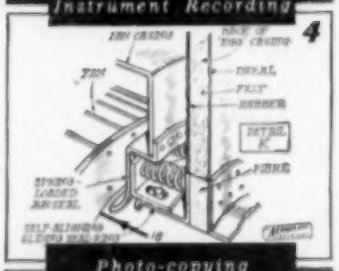


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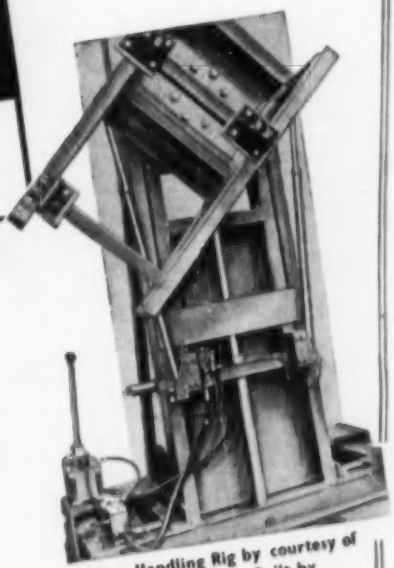

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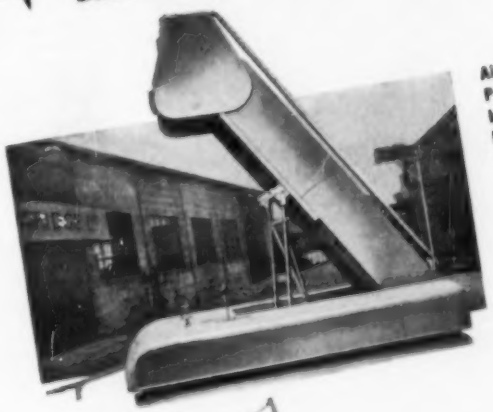

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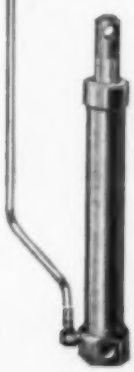

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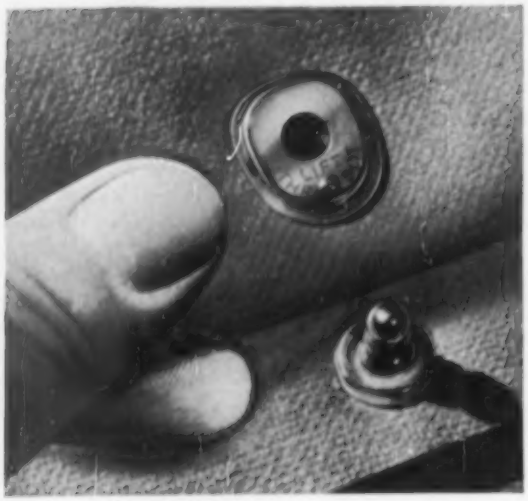

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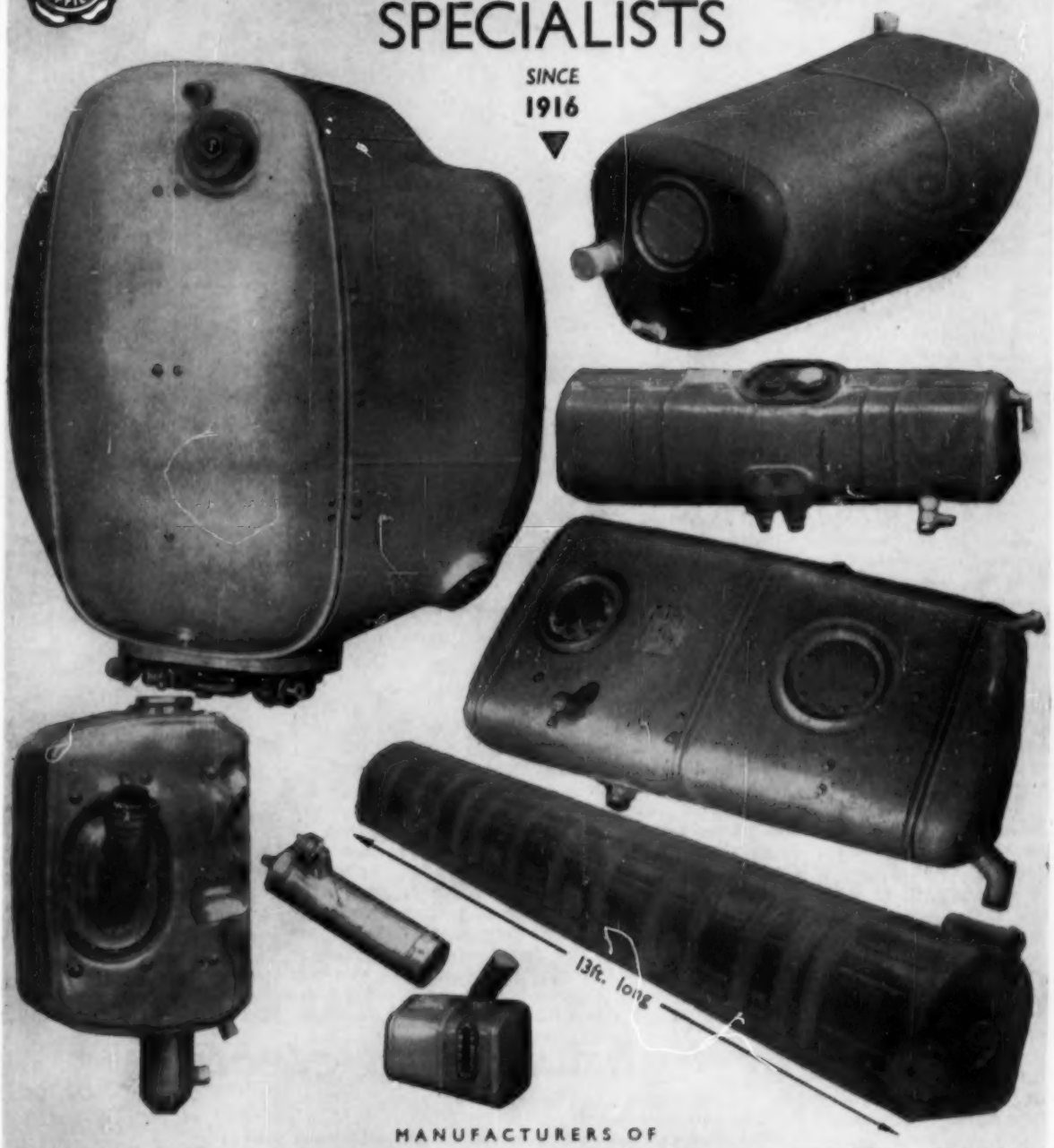


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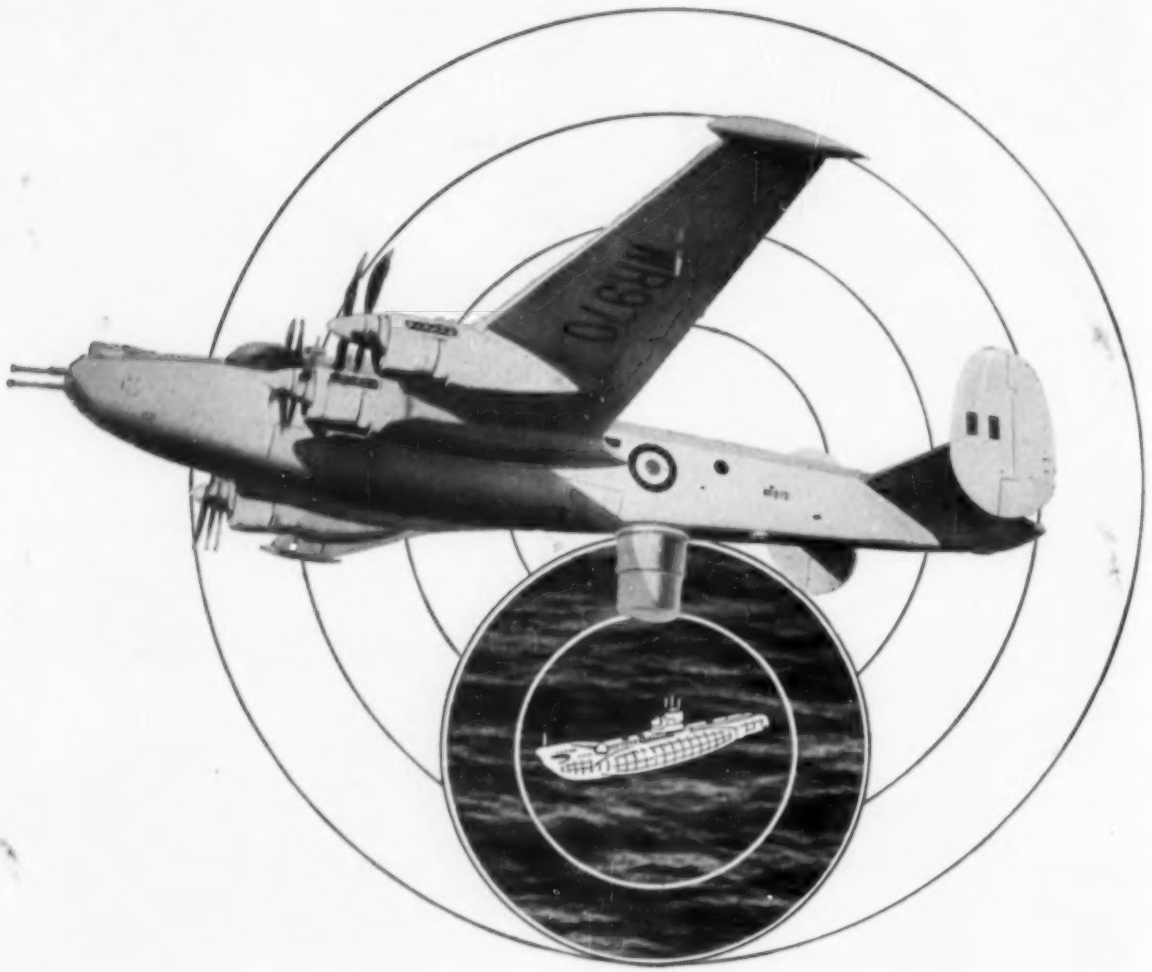

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EDITOR
MAURICE A. SMITH, D.F.C. and Bar

ASSISTANT EDITOR
H. F. KING, M.B.E.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:

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IN THIS ISSUE:

The New Training - - - 5
Swiss Guided Missile - - 7
All-weather Mystère - - 10
High-lift Generation - - 12
Bush Pilot's Album - - 16
Hawker Siddeley Progress 19
East African Airways - - 20
Wing Drop and Pitch-up 22
New Year Honours - - 30

## Adversity—and Recompense

WHEN the future brings 1954 into perspective it may come to be regarded as less of a black year for British aviation than it appears today. Its passing, unlamented, seven days ago, left memories of disaster and destruction, of delay and disappointment. Unfortunately, it is not just the careless or complacent who have to learn the hard and bitter way; almost all progress, and certainly all the real pioneering work, is achieved in the face of great trials and difficulties. Of one thing there is no doubt: that technical experience and knowledge has been accumulated to an unprecedented degree during the past year. In particular the Comet investigation, taken together with the considerable previous airline experience with this type of aircraft, has provided deeper and wider knowledge of jet transports, their construction and their operation than could possibly have been acquired in any other way. This at least guarantees a firm new foundation upon which to build.

Even the year's severe losses of prototype aircraft, large and smaller—and Great Britain has not suffered alone in this respect—have not in every case been wholly in vain. The price of progress paid in life and material has nevertheless been too great.

But it is neither natural nor desirable at the beginning of a new year to dwell for long upon setbacks and other sombre matters; and to express now both hope and confidence in events and achievements foreseen for the coming months is not to be unduly optimistic, for the promise is great. Throughout 1954 the progress and sales of the Viscount were a constant source of encouragement, and it will be during the coming months when these aircraft are being completed in increasing numbers and are seeing service in North America and Australia that the full measure of this success story will be revealed.

For reasons of security, and of commendable reserve on the part of the makers, the English-Electric P.1 has so far remained in the background. Yet the more the overall picture is examined the more the conclusion is brought home that this machine shows much above average promise; its characteristics seem in every way to add up to the right answer. There is good reason to assume that the name of the P.1 (no doubt it will have a name by then) will have figured largely in our pages twelve months hence.

Another subject over which there is good cause for elation is in the nature of a hardy perennial. We refer to the progress and promise among the products of the aero engine manufacturers. Production of the powerful current marks of Avon and Sapphire, and of the civil Dart, are, according to all information, most gratifying. Progress reports on the development of the Olympus, Gyron, Conway, Eland, Soar and Oryx suggest that these units are well up to their various programmes. For a little later—and indicative of the lively and enterprising outlook of design teams—there are, just around the corner, the new turboprops B.E.25 and R.B.109, the Orpheus and the Canadian Waconda—if that is in fact to be the name accepted for the advanced new engine—not to mention the small Turmo and Twin Turmo and rocket motors, hot and cold.

We would not feel ready to claim that the limit of enterprise and energy has been reached in the aircraft industry; it is scarcely possible to have too much of either. If some people are to be believed, the aircraft industry lacks both, and is feather-bedsteaded or otherwise buoyed up by military contracts and the coverage of development costs by the State. This can hardly be reconciled with the facts in any class of product; where else, for example, are four new civil aircraft such as the Herald, Twin Pioneer, Accountant and Folland transport being designed and developed specifically to suit operators and take over world-wide duties which the so long omni-competent DC-3 must progressively relinquish. Money will continue to be found by manufacturers and operators for the design and construction of new civil aircraft and for their purchase. No one, on the other hand, underestimates the difficulties which smaller operators face when for the first time they must buy brand-new aircraft, even of the modest proportions of the types named above.

The enormous costs of developing, testing on the ground and in the air and proving large airliners, particularly in view of the experiences and new knowledge which have been gained during the past year, are another matter, and one which may well have to be met directly or indirectly on a national scale in all countries.

*HUNTER DELIVERIES were recently described by the Under-Secretary of State for Air (see paragraph on this page) as having "largely caught up." Certainly these "Daily Express" views of a line-up at No. 5 M.U. (W/C W. N. Elwy-Jones) augur well for the New Year. In all, twelve machines were on parade. Observant readers will spot the ground-covers over the auxiliary intakes.*

# FROM ALL QUARTERS

## Fighter Production

IN relation to the production programme of March 1953, deliveries of Hunters, which at one time fell badly behind, have now largely caught up. This was announced in the House of Commons recently by Mr. George Ward, Under-Secretary of State for Air. The Swift, he said, was "another story altogether." Originally, he recalled, it was developed as a private venture from a research aircraft commissioned by the Ministry of Supply. This research aircraft—the 535—was built to test some of the problems involved in the operational requirements issued in 1948 for an aircraft to replace the day fighters then in service. It was thought in 1950, when production orders were placed for the Swift, that, with the Hunter, it would meet the needs of the Royal Air Force. Since then, more than one version of the original design had been built. Aerodynamically difficult problems had been encountered, and it was not yet possible to say whether all these difficulties could be overcome in all the versions which were now under development.

## R.C.A.F. Equipment and Training

MOST of the twelve squadrons in the NATO Air Division of the Royal Canadian Air Force are now equipped with Orenda-powered Sabres. This is announced in an end-of-the-year statement by the R.C.A.F. During 1954, it is recalled, plans were announced for the acquisition of a number of P2V-7 Neptunes, and work began on a maritime version of the Bristol Britannia. The decision was taken to introduce the Chipmunk into the pilot-training programme for the regular R.C.A.F., this move having been approved after test-courses had determined the desirability of providing the first 20 or 25 hours of training on the Chipmunk rather than on the Harvard. The new plan, when it is implemented, will reduce wastage and training costs. Students will subsequently advance to the Harvard. [A scheme in almost direct contrast with that of the R.A.F—see p. 5.—Ed.]

Late in September the first of ten Sikorsky S-55 helicopters was delivered. The R.C.A.F. has also received six twin-rotor Piasecki H-21A helicopters for search and rescue. A number of Auxiliary fighter squadrons were issued with T-33 Silver Star jet trainers.

Reference is also made to the "Pine-tree chain" of radar installations. Construction of a more northerly system, "generally to the north of the settled territory in Canada," is under way and is referred to as the "Mid-Canada Line."

## This Year's Air Racing

THIS year's National Air Races will consist of four meetings, each comprising five races, and each race counting towards one of the five trophies awarded (excluding the King's Cup). The trophies are: the S.B.A.C. Challenge Cup, for aircraft whose maximum speed is more than 160 m.p.h.; the Air League Challenge Cup, for Percival Proctors; the Kemsley Challenge Trophy, for aircraft with a maximum speed of more than 130 m.p.h. and not included in either of the foregoing classes; the Norton Griffiths Challenge Trophy, for D.H. Tiger Moths; and the Grosvenor Challenge Cup, for Austers (and for aircraft, other than Tiger Moths, with a maximum speed of up to 130 m.p.h.). In each case competing aircraft are limited to a maximum weight of 1,750 kg (3,358 lb). The meetings will be held at Fairwood Common on April 30th, Yeadon on May 28th, Whitchurch on June 11th and Baginton on August 20th (when the King's Cup Race and an international aerobatic competition will also be held).

## Orpheus and the Light Fighters

IN connection with the report of the first bench-test of the Bristol Orpheus, an Italian source asserts that the result of the recent NATO light fighter design competition was (1) Bréguet 1001, (2) Fiat G.91, and (3) Avro 720. The report continues that, while each of the companies concerned has been asked to submit an estimate for three prototypes, four prototype Orpheus engines have already been ordered. An order for a pre-production batch is expected this month, after the first bench tests.

## Bomb-plotting by Decca

SOME further facts are now available which amplify the rather sketchy information given in a recent Parliamentary reply concerning the resumption of R.A.F. bombing practice at the Theddlethorpe (Saltfleet, Lincs.) range. It is learned that the new plotting equipment which has been installed is a special version of standard Decca radar equipment. Exhaustive trials have shown that practice bombing can be observed and plotted without danger to life, and that the site of any range so equipped can be chosen with greater freedom and the safety area extended.

Another Decca Radar contract is for the installation of a Type 424 equipment for use by the Ministry of Supply's Armament and Instrument Experimental Unit, Martlesham Heath. The order follows extensive accuracy and performance trials at the A.I.E.U.

## C-130 Innovations

THE executive vice-president of the Lockheed Aircraft Corporation, Mr. Courtland D. Gross, has disclosed that the C-130 Hercules transport (*Flight*, December 10th, 1954) will have a "new-type pylon tank with external self-sealing provisions." No such development has previously been reported.

Mr. Gross mentioned, among other features, a "satisfactory engine decoupler and a satisfactory torquemeter drive shaft; a new system to bleed hot air from the gas turbine engine with new-type ducts capable of withstanding high pressures and temperatures; and design of a new actuating system to vertically lower and raise the unusual tandem landing gear." He felt sure that the C-130 would become "a key part of the new airlift economy that is rapidly developing all over the world."

## C. C. Walker Retires from D.H. Board

THE de Havilland Aircraft Co., Ltd., announced last Monday that Mr. C. C. Walker, C.B.E., A.M.I.C.E., Hon. F.R.Ae.S., Hon. F.I.A.S., has retired from the company's Board as from the close of 1954. "His decision to do so," it is stated, "is in no way influenced by lack of good health, but he feels that he should shed some of the executive responsibility which he has carried for so long, having been a director of the company since its formation in 1920. He will continue in his day-by-day service so that his exceptional judgment and fund of knowledge will be drawn upon as in the past and his invaluable influence will continue to be enjoyed."

*Mr. Walker.*

After training as a civil engineer, he joined Capt. Geoffrey de Havilland at the Aircraft Manufacturing Co., Ltd., at Hendon early in 1915, when the D.H.1 and 1A two-seater fighters were being developed, and ever since then his influence has been seen in de Havilland designs. He was a founder director of the de Havilland company when it was formed in 1920 and from then up to the present day he has headed the aerodynamic side of the organization.

One of the best-known members of the industry, Mr. Walker has served for many years on the councils and committees of the R.Ae.S., A.R.B., S.B.A.C. and other bodies. He was awarded the R.Ae.S. Silver Medal in 1935, in recognition of his work in civil aircraft design and in 1938 he was made a Fellow of University College. He was appointed C.B.E. in the Birthday Honours of 1948. His work is equally well known in America, where, in 1952, he was elected an Honorary Fellow of the Institute of the Aeronautical Sciences.

***A KNIGHTHOOD** is announced in the New Year Honours List for Rear-Admiral M. S. Slattery, chairman and managing director of Short Bros. and Harland, Ltd. Names of aviation personalities in the list appear on page 30.*

***STAPP STRAPPED:** Lt.-Col. John P. Stapp is harnessed into the seat of the Northrop rocket-propelled sled at Holloman Air Development Centre before his amazing 632 m.p.h. dash (see news item below).*

## One-man Open Sleigh

A STATEMENT issued by the U.S.A.F. says that Lt.-Col. Stapp, who recently made a 632 m.p.h. dash aboard a 2,000 lb rocket-propelled rail sled at Alamagordo, New Mexico, suffered no lasting ill-effects from the subsequent one-and-a-half-second full stop; he did, however, receive a few blood-blisters from dust particles in the air, and two black eyes, the latter caused when his eyeballs were thrown forward into his eyelids during deceleration. He was subjected to 35 g, which brought his effective weight up to the three-ton mark.

Lt.-Col. Stapp, who is 44 years old, has made many of the runs and sudden stops on the sled (built by Northrop) since the test programme started some time ago. Even higher speeds are to be attempted, the object being to assess the reaction of the human body to high deceleration and exposure to air blast during escape from aircraft. Previously, hydraulic friction-brakes were used for deceleration, but the latest test was made with a water brake.

Although Col. Stapp had blacked-out from acceleration by the time he reached the brake, he did see part of the splash before "redding-out" fairly violently while stopping.

But he did not lose consciousness and was able to remember his sensations. Although initially blind after the run, he soon recovered his sight and was able to take sustenance. His only protective equipment, apart from special harness, was a plastic helmet with jaw-guard and transparent visor.

## Saving the World's Food

A CHANGE of name coincides with the celebration of the tenth year of agricultural operations by Pest Control, Ltd. Work started in 1945 with a Sikorsky R-4, and three years later an S-51 was delivered; by this time Pest Control was established at Bourne, Cambridge, and was preparing in addition to its normal work to pioneer both aerial spraying by night and to take out the first helicopter ever to fly in Africa.

In a recent report on activities, the first to be issued since the company changed its name—to Fisons Pest Control, Ltd.—on December 31st, reference is made to early and continuing research. Behind the design of the helicopter spray-bars and nozzles, for example, lay much study of the formation and behaviour of spray droplets. In a different field are the activities of a team of entomologists and biologists at Chesterford in Essex, who are working on the destruction of weeds and insect pests. It is mentioned, in this connection, that a single acre of land may contain 160 million weed seeds and that insect pests in the world every year destroy enough food for 200 million people. At Harston, Cambridge, what is believed to be the largest installation in the world for the manufacture of hormone weed killers was erected last year for the production of Phenoxylene Plus.

The danger last year to Forestry Commission pines attacked by the pine looper moth will be recalled. The areas concerned were Cannock Chase, Staffordshire, and Culbin Sands on the Moray Firth. Aerial spraying saved 6,000 acres of pines in these two areas. Overseas work has continued and expanded in Egypt and the Sudan, in Rhodesia, Kenya, the Gold Coast, Ceylon and elsewhere, including, nearer home, Normandy where Colorado beetles are the pest. Subsidiary companies operate in Africa and Pest Control (Ireland), Ltd., has now been established in Dublin.

Negotiations whereby Fisons, the well-known fertilizer manufacturers, would take over Pest Control, Ltd., were first reported in January of last year; Mr. A. Wormald, commercial director of Fisons, became managing director of Pest Control in April.

## FROM ALL QUARTERS . . .

### Wills Flies High

REACHING a height of more than 30,000ft over Mount Cook, New Zealand, on December 29th, Philip Wills set up new British gliding records for absolute altitude and for gain of height (28,200ft). Previous British records were respectively 22,430ft, set up by Wills in Spain in 1952, and 19,120ft, by A. F. ("Bill") Bedford in 1950. For the Mount Cook flight Wills used a Weihe sailplane which, it is reported, was still rising when he was forced to bring it down as a result of extreme cold and the cracking of its cockpit canopy. The world gain-of-height record is at present 30,098ft.

Other gliding news from the Antipodes is that the Australian national gliding championships, held on a de-centralised basis, have recently begun. The use of one base was ruled out because of the prohibitive cost of transporting sailplanes over long distances. Spread over a 25-day period, the championships comprise free distance, goal, and out-and-return competitions, with bonus points awarded for speed.

### Otters for the U.S. Army

IT is announced that 84 de Havilland Canada Otters have been ordered, probably as the C-137, by the United States Army; the total contract price is reported to be approximately $10m (£3,571,000). This is very welcome news, for it may well herald further large American orders for the type. The new contract exceeds the total order-book for the Otter; this stood at about 60 aircraft, of which some 45 have been delivered.

It will be remembered that, several months ago, six Otters were delivered to the U.S. Army for evaluation at Fort Bragg, North Carolina. These aircraft performed excellently and—according to some observers—appeared to match the best that could be done by both fixed-wing aircraft and helicopters.

D.H.C. have the distinction of being virtually the only non-American firm supplying aircraft to the armed forces of the U.S.A. The Otter's smaller forebear, the Beaver, has already been supplied to the Army and Air Force, to a total of over 300 machines.

### English Electric Liaison

FOLLOWING the resignation of W/C. R. R. Stanford-Tuck, W/C. P. D. W. Hackforth has joined English Electric as assistant aircraft liaison officer. He will be based at Warton, and his duties will mainly concern liaison with R.A.F. Canberra squadrons.

Born in India and educated at Oundle, W/C. Hackforth won a prize cadetship to Cranwell and was commissioned in the R.A.F. in 1934. During his Service career he has been employed on specialist signals and radar duties, has commanded two bomber squadrons (Nos. 115 and 170) and has been station commander at Swanton Morley. From 1951 until his retirement in November, 1954, he was British air attaché in Caracas, Venezuela, in which post he was concerned with eight Caribbean countries.

### Yet Another J47

SINCE the General Electric J47 first went into production in 1947 it has probably been made in greater numbers than any other post-war aero engine—Sabres and Stratojets alone account for over 20,000.

One variant was developed with an afterburner (the D-series), the production version of this series being the J47-GE-17, for the F-86D all-weather Sabre intercepter. Late-model F-86Ds are now receiving the J47-GE-33, in which several improvements have been incorporated. These include new inlet guide-vanes which permit a greater mass flow during full-speed running, either dry or with afterburner; a capacitor-discharge ignition system; a fully floating turbine shim shroud; a "hot-streak" afterburner-ignition system (see pp. 642-3 of October 29th, 1954, issue); a ceramic liner for the afterburner; and a larger variable-area nozzle.

With the GE-33 installed, the F-86D requires about 20 per cent less time to reach 45,000ft from a standing start. Static thrust with afterburner is probably about 8,000 lb.

*THE COLLIER TROPHY, awarded in Washington jointly to Mr. James Kindelberger of North American Aircraft and Mr. Edward Heinemann (right) of Douglas Aircraft. The award recognizes their achievement in producing, respectively, the F-100 and the Skyray.*

### Inspection Appointment

*Mr. Folland.*

ON January 1st Mr. E. H. S. Folland was made group chief inspector to Blackburn and General Aircraft, Ltd. A son of the late Mr. H. P. Folland, he has held A.I.D. appointments in several well-known factories. In 1945 he was appointed senior production officer of the Ministry of Supply for the standardization of aircraft equipment. In 1947 he resigned from the M.o.S. to become chief inspector to Dowty Equipment, Ltd. Since 1951 he has held a similar appointment with Folland Aircraft.

### Hot Secret

IT is reported by *American Aviation* that British fighters—the Gloster Javelin first, and others later—are to be armed with a de Havilland air-to-air missile which homes on to sources of infrared (i.e. heat) radiation. Such a method of homing has been discussed for years, and it has singular merits. Whether or not the report is correct, however, cannot be stated.

*DORNIER Do25: At Getafe airport, outside Madrid, is seen the new German-designed, Spanish-built general-purpose monoplane. Initially powered with a Tigre G-IVA of 150 h.p. it is stressed for engines up to 260 h.p. All fuel is carried externally. Note the remarkable cabin window and windscreen arrangements.*

# THE NEW TRAINING

## *First Provost-Vampire Course Completed*

*Air Marshal T. G. Pike, Deputy Chief of the Air Staff, presents the commissioning parchment to F/O. A. B. Musgrave, who won the Trophy of Honour as well as the Ground School Trophy.*

THE first course to complete training entirely in the Provost-Vampire sequence passed out from No. 5 F.T.S. at R.A.F. Station, Oakington, on December 22nd. The reviewing officer at the parade was Air Marshal T. G. Pike, C.B., C.B.E., D.F.C., Deputy Chief of the Air Staff, who congratulated the course on its good performance and wished them luck as pioneers of the new training system. The parade was also the first occasion on which the parchments of the Queen's Commission were actually presented to pilots when they marched up to receive their Wings. Thus is a pre-war custom resumed.

The parade commander, and winner of both the Trophy of Honour and the Ground School Trophy (awarded respectively, for all-round and ground-school achievement) was F/O. A. B. Musgrave. He is a university graduate, and served in a university air squadron before taking a regular commission. The Air Pilotage Cup for the greatest proficiency in general flying was won by P/O. J. R. Potter, and the No. 5 F.T.S. Aerobatic Trophy by P/O. G. T. Hussey.

No. 5 F.T.S. was first formed at Sealand, Cheshire, in 1922 and, after a distinguished war-time record of pilot training, was transferred in 1946 to Thornhill, Southern Rhodesia. In June 1954, No. 206 Advanced Flying School, Oakington, was renumbered No. 5 F.T.S. and became the first training school to produce pilots under the new Provost-Vampire scheme. The Vampire T.11s and 5s are operated at Oakington, the Provost stage being completed at other airfields—Ternhill, in the case of No. 101 course which passed out on December 22nd.

The course went through the Aircrew Selection Centre at Hornchurch in June, 1953, and completed initial training at No. 2 I.T.S., Kirton-in-Lindsey, in August. Flying training began in mid-September, 1953, and the Provost stage of 120 hours ended on April 21st last year. During this stage, seven trainees were found to be unsuitable and rejected. Of the 20 who went on to Vampires at Oakington, only two were rejected, leaving 18 to qualify. Three of the 18 are National Servicemen, and since only the best are now allowed to train as pilots during their National Service, they were placed very high in the final assessments.

Flying performance as a whole was classed "good average" with instrument flying, aerobatics and formation flying "very satisfactory." Each pupil completed at least ten hours' night flying, and the average time to acquire a white instrument rating was 14 hours. Average time to solo on Vampire was 7 hr 50 min. Half of each working day was spent on ground training, and the wings examination was taken in the 26th week of the course. F/O. Musgrave here set a very high target for future courses by achieving an average of 85 per cent.

Because all the Vampire T.11s were completely new and at first required a number of modifications, serviceability was not very good, and a backlog of flying built up which it was found very difficult to dissipate. Eventually, a five-week extension of the course was granted. Bad weather subsequently intervened to make the situation even more difficult, but with evening and week-end flying the position was substantially retrieved.

During a total of about 2,700 Vampire sorties (most solo flying is done in Vampire 5s) there were only two avoidable accidents, both of them involving voluntary retraction of the undercarriage on the ground after landing too fast.

Few conclusions can yet be drawn as to the precise effect of the new training sequence, but it is certainly true that the main stumbling-block of jet conversion is now overcome before a pilot gains his Wings so that, as soon as he reaches this stage, his usefulness to the Service is guaranteed. Under the older system, he spent some 12 months and 220 flying hours on a piston-engined aircraft, received his wings and then required a jet A.F.S. course lasting four months—and this often proved his downfall. The new sequence takes approximately the same time as the old, but involves the saving of 70 flying hours with, in contrast, 30 hours' more jet flying than before. Both the saving of flying hours and the better-guaranteed human product constitute distinct economic advantages.

As for the pilots themselves, their early acquaintance with jet aircraft has not led to any particular problems. On the contrary, it has enabled their suitability to be conclusively assessed at a much earlier stage of training than before. The proportion of rejections between basic and advanced flying are evidence of this. Both the Provost and Vampire are more advanced than their respective predecessors but, though they may be slightly more complex, they are not inherently difficult to fly. They are certainly more inspiring, because of their greater power and performance, and they offer the pupil much better flying experience during training—the sort of experience that will be of most immediate value on joining a squadron.

Though it is considered important that emphasis should be laid on the power to absorb knowledge and skill quickly in present flying training methods, instructors are well aware that some of the better pupils develop slowly. If this is found in a particular case, it is not impossible for a pupil to be retained for a longer period of training. However, in many cases, slow progress may be irremediable and advancement may eventually cease altogether, in which case rejection is the only course left.

In some cases, progress will cease more or less abruptly, and lead finally to rejection. The cause is extremely difficult to trace, even when it is possible to subject the individual to close examination. Under the former scheme, which provided for jet A.F.S. training after receipt of Wings, the many pilots who were rejected had to give up their brevets. This is considered to have been a bad practice, regardless of the reason for it, and to have had a detrimental effect upon morale. Incidentally, National Service trainees who do not undertake to complete an engagement with the Auxiliary Air Force after their full-time service retain their Wings but do no more flying.

Of the 18 who passed out at Oakington, one is to complete his National Service in a non-flying posting, one is to go to bombers, and the remainder are to be divided between day, night or ground-attack fighter units. They will fly the various marks of Meteor or Venom. It is probably true to say that the new training sequence is paying excellent dividends, but a more detailed judgment will probably not be possible until a number of the new courses have been completed.

*Other award winners in the course were (left) P/O. G. T. Hussey, Aerobatics Trophy, and (right) P/O. J. R. Potter, Air Pilotage Cup.*
*"Flight" photographs*

# HERE AND THERE

*HIGH ADVENTURE: Many who knew the Burnelli design when it was taken up in this country before the war by Cunliffe Owen Aircraft, Ltd., will have their memories jogged by this picture of an aircraft of similar type. It is to land the main party of an Arctic expedition at the North Pole next March. Built since the war by Concargo, the Loadmaster, as it is known, will carry 20 expedition members and 41 dogs from Alert, on the northern tip of Canada.*

### To Teach New Luftwaffe

FOUR R.A.F. pilots have transferred to the U.S.A.F., under a mutual exchange system, in order to train pilots of the new West German Air Force. They will be based at Fürstenfelbruck, where T-6 Harvards and T-33 Shooting Stars will be available. The West German Air Force will consist of about 80,000 officers and men, and 1,300-1,400 aircraft. A planning staff has long been working in Bonn.

### Former Production Chief Dies

THE death occurred, in Jersey last week, of Brig-Gen. Sir William Alexander, at the age of 80. During the First World War he was Controller of Aircraft Supply and Production, from 1917 to 1919.

### Young People's R.Ae.S. Lecture

THE subject of a Royal Aeronautical Society lecture to young people, due to take place in London yesterday, January 6th, was *Great Events in Aviation*. The author, Mr. Peter G. Masefield, M.A.(Eng.), F.R.Ae.S., F.I.A.S., described the more significant famous flights, illustrating them by specially drawn track-charts.

### Long-Range Missile Testing

IT is officially announced that the United States Government is negotiating an arrangement with Great Britain to extend the U.S.A.F. guided-missile range at Banana River, Florida, to St. Lucia, in the Windward Islands, and to Ascension Island, in the South Atlantic. Under a 1950 agreement the proving ground at present stretches from Florida through the Bahamas to Puerto Rico. This news has been linked with the following extract from the recently published annual report of the Northrop Aircraft Company: "The company continues development of the Snark B-62 pilotless bomber under a programme that began in 1946. Northrop maintains an operating facility at the Air Force's missile test centre at Florida, where a proving programme is currently being carried out jointly with the U.S. Air Force."

### For the Record

AMONG reprints, in brochure form, from recent special numbers of *Flight* is *British and Commonwealth Aircraft*, reprinted from the August 27th and September 3rd special issues. Giving descriptions and specifications in 51 fully illustrated pages, it is obtainable by post at 2s 3d from Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

### Super Sub-contracting

IN their review of 1954 activities the Boeing Airplane Company report that throughout the year they continued their broad sub-contracting programme for the production of the B-47 Stratojet, B-52 Stratofortress, KC-97 Stratofreighter, and Model 707 jet tanker/transport. The Wichita Division alone now has 1,868 subcontractors and suppliers throughout the nation, nearly three-quarters of them—by Government definition—"small business firms employing less than 500 persons." In turn these suppliers buy from other sources, about 79 per cent small firms.

### M.T.C.A. Gets Its Teeth Into It

ON page 25 of this issue is a photograph of a crash-rescue power-saw demonstration at London Airport. Since the page closed for press, we have learned from the Ministry of Transport and Civil Aviation that equipment of this kind is to be provided at London Airport, Prestwick and Hurn by the end of this month, and at other major airfields shortly thereafter.

### The Sapphire-Vautour

IT is announced that the third prototype of the S.N.C.A.S.O. 4050 Vautour, illustrated in *Flight* of December 17th, is fitted with two Armstrong Siddeley Sapphire 6 turbojets, each of over 8,000 lb thrust. The claim is advanced that the high thrust and low fuel-consumption of the Sapphire, together with its compact size and low specific weight, give the aircraft greatly enhanced performance. Production versions will have S.N.E.C.M.A. Atars.

### Creeping Like Snail?

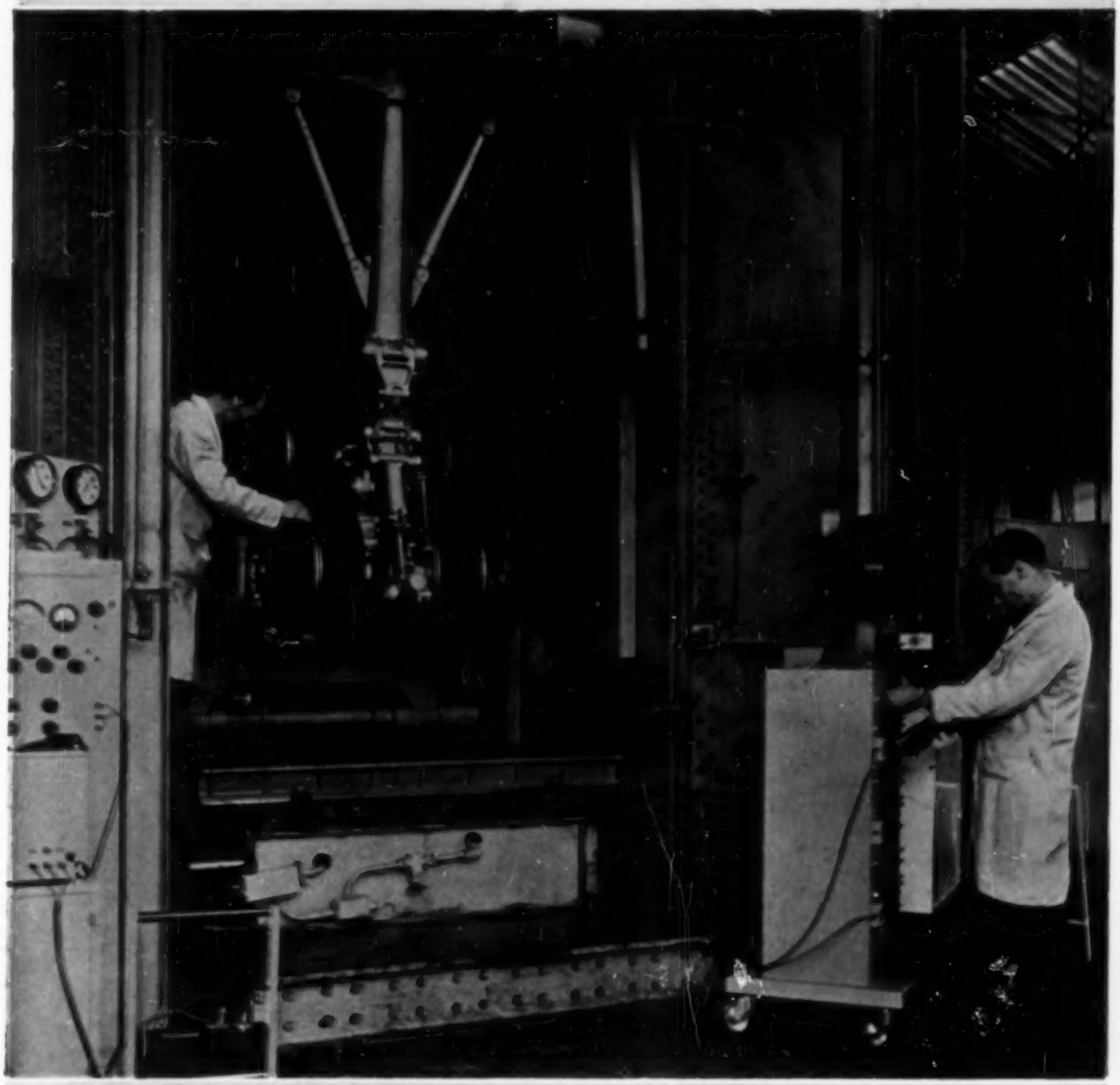
ONE of the attractions at the Schoolboy's Own Exhibition (Royal Horticultural Halls, Westminster; open until January 13th) is an Air Trainers' AT. 100 transport-aircraft simulator, erected on the Shell-Mex and B.P. stand. Young visitors are invited to "fly" the aircraft over a set course and are afterwards given a trace of the track they have actually followed. Other items in the exhibition include models and photographs of aircraft and guided missiles on the English Electric stand.

### Bringing It Home

RADIO AUSTRALIA reported last week that Capt. Frank Roche and his wife had arrived safely at Cairns after an eventful flight from England in a D.H. Rapide, which they are to use for ambulance duties (page 828, *Flight*, December 10th). On the Timor Sea section of the flight a severe storm damaged the aircraft windows and rain flooded the cabin. There was also a radio fire, which Mrs. Roche extinguished. Frank Roche is the author of the article "Bush Pilot's Album," in this issue.

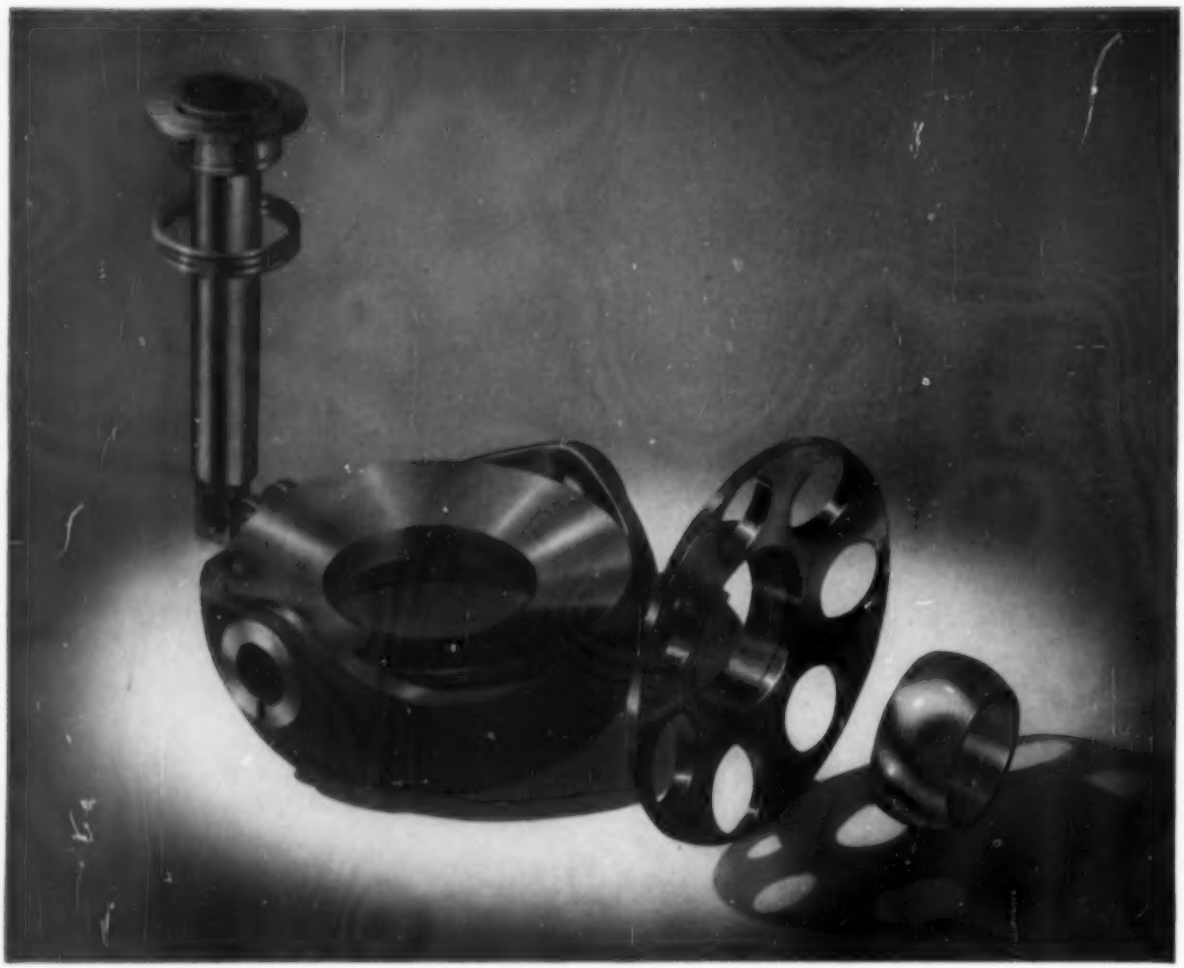
*FOREIGN AIR ATTACHÉS photographed during a recent visit to the Brentford factory of the Sperry Gyroscope Co., Ltd. Left to right: S/L. D. A. Peacock, D.F.C. (escorting officer), Lt. F. Gomez, of the Dominican Republic; Col. G. Marin, Chile; Col. A. L. Haley, U.S.A.; Lt.-Col. J. K. Sarvanto, Finland; Lt.-Col. E. Sandberg, Norway; and Lt.-Col. M. Dahlan Djambek, Indonesia.*

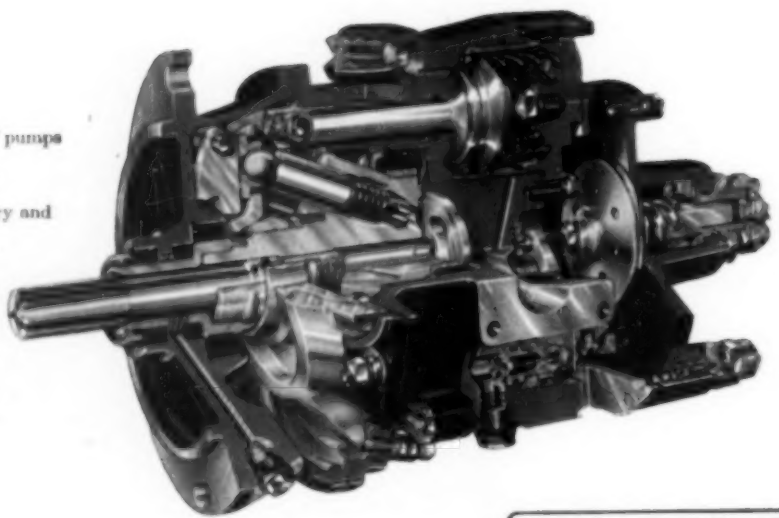
# RESEARCH



*Colour Photograph by The Times "REVIEW OF INDUSTRY"*

ELECTRO-HYDRAULICS
LIMITED WARRINGTON





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# SWISS GUIDED MISSILE

## *A Revealing Description of the Oerlikon Ground-to-Air Guided Missile Type 54*

WHEN one reflects upon the amount of information available upon British developments in the sphere of guided weapons, it comes as something of a shock to be able to publish a quite comprehensive description of a modern guided missile, together with its associated ground equipment.

The weapon concerned is the Type 54 anti-aircraft missile developed by the Oerlikon Company of Zurich, Switzerland. Its development has proceeded for several years past and the equipment is now at the stage at which it can be regarded as ready for service—an extraordinary achievement for a private company in a small country. The missile itself has cruciform delta wings which produce the lift forces necessary for following the required flightpath. At the rear, four smaller cruciform fins are fitted, used for steering purposes after burn-out (i.e., the point at which the missile's tanks run dry). During powered flight, steering is accomplished by a combined gas jet/rudder mechanism, as described later. The propulsion unit has a single chamber, fed with fuming nitric acid and kerosine. The overall length of the missile is about 6 metres (19ft 8in), the maximum diameter approximately 40 cm (15¾in), and the take-off weight approximately 350 kg (771 lb).

According to the makers' description, the fuselage is wound in light alloy and glued with a metal bonding adhesive [this implies a wrapped-sheet form of manufacture]. The wings, which are of sandwich construction, are displaceable in a fore-and-aft direction to compensate for changes in the centre of gravity position and lift force. The propellants are fed by compressed nitrogen, initially at 300 atmospheres, and are ignited by an injection of triethylamine and xylidine; the thrust is 1,000 kg (2,205 lb), the duration of thrust 30 sec, and the total consumption 11 lb/sec. Burn-out altitude is approximately 9 km (nearly 30,000ft) although the missile can be steered to an altitude of 15 km (over 49,000ft).

Before continuing with the description of the missile, an outline must be given of the type of guidance system employed. The Oerlikon missile is a beam rider, that is to say, it automatically searches, during the entire duration of its flight, the centre of a radio beam which is continuously directed towards the target. Thus the missile is guided to its target even when the latter carries out evasive manœuvres.

The advantage of the beam-riding system (say Oerlikon) lies in its simplicity. Without any supplementary ground equipment this system permits guidance of several missiles up the same beam on to a target or on to a zone of targets. One of the greatest problems in the determination of anti-aircraft ballistics, namely, the lead (or aim-off), is entirely eliminated, since the missile flies continuously within the guiding beam and therefore always endeavours to intercept its target.

A diagram on page 8 shows the trajectories which would be followed by a number of missiles launched at regular intervals from the same battery and all guided along the same beam towards the same target. The diagram assumes, of course, that the target maintains a straight and level flight path.

Another diagram shows the ground organization required to control the operation of a guided missile group; this layout is standard and applies to either an army or an air force.

The group is composed of a central command post and three firing batteries. The former is equipped with a putter-on radar equipment, and each battery has its own radar tracker. The battery tracking equipment is also provided with a telescope so that, under suitable conditions, a target can be tracked optically. It is presupposed that early warning of the approach of enemy aircraft can be provided up to a distance of approximately 300 km (187 miles) by a network of long-range radar stations. In the absence of such a network the sky would be continuously scanned by the group putter-on radar set, which has a range of 100 to 200 km (62 to 124 miles). Targets located by the group putter-on radar are transmitted to the individual batteries by the group command post and are then tracked by means of the battery radar tracker which, in turn, controls the beam transmitter and the missile launcher.

*Standing on its twin launcher, the Oerlikon Type 54 missile presents a fearsome aspect. The maximum Mach number is 1.35.*

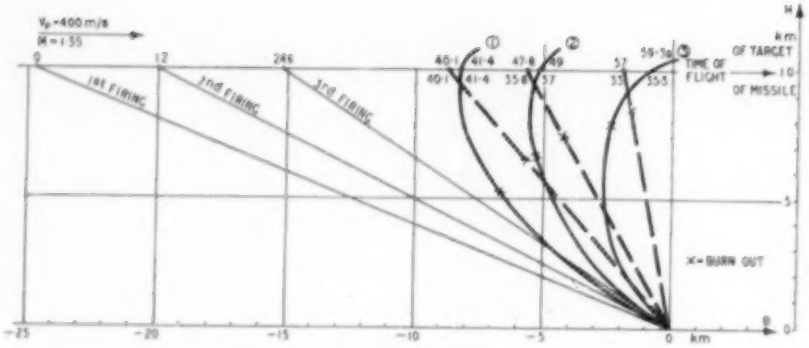
The information transmitted to the battery tracking team consists of the azimuth ($\alpha$) and distance ($r$). The tracker then scans in a limited elevation zone (denoted by the symbol $\lambda$) and reports back to the group command post as soon as it has located the target. The transmission of this information from the group to the battery tracker and *vice versa* is effected *via* a parallax computor, whereby the parallax distance between the group putter-on radar and the battery tracker may amount to 15 km (over nine miles).

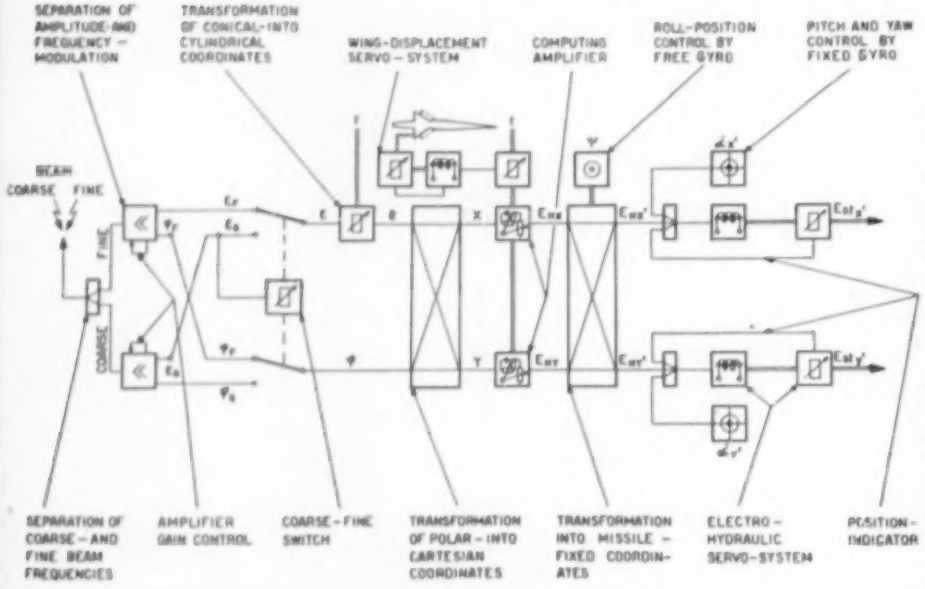
There is a centralized computor unit, shown in one of the accompanying illustrations. Centralized within this unit are the following items: a parallax computor between the putter-on radar and the battery radar tracker; a co-ordinate transformer for the target searching movements of the battery tracker; a parallax computor between the battery tracker and the beam transmitter (maximum parallax 800m or roughly half a mile); a computor to compensate for the displacement of the missile relative to the centre of the beam, resulting from beam movement; and a computor between the transmitter and the launcher. The latter equipment is a co-ordinate transformer which determines the amount of lead required at launching and also makes allowances for the angle of attack of the missile to be added to the basic angle of elevation.

Another illustration shows the beam transmitter, which, like all the other ground facilities of the missile group, is mounted on a wheeled chassis. The transmitter is equipped with an aerial system providing for coarse and fine beams, the two aerials being arranged coaxially and driven by the same motor. The coarse beam has an included angle of 20 deg and serves to "catch" the missile after the launching and to guide it towards the fine beam. The latter has an included angle of 3 deg and is used to direct the missile on to the target.

## SWISS GUIDED MISSILE . . .

*On the right are trajectories of pursuit for missiles fired in succession from the same launcher at the same target. The large diagram below gives an outline of the actual control system employed by the Oerlikon Type 54 guided missile.*





SEPARATION OF AMPLITUDE AND FREQUENCY – MODULATION
TRANSFORMATION OF CONICAL- INTO CYLINDRICAL COORDINATES
WING-DISPLACEMENT SERVO – SYSTEM
COMPUTING AMPLIFIER
ROLL-POSITION CONTROL BY FREE GYRO
PITCH AND YAW CONTROL BY FIXED GYRO
BEAM
COARSE
FINE
SEPARATION OF COARSE – AND FINE BEAM FREQUENCIES
AMPLIFIER GAIN CONTROL
COARSE – FINE SWITCH
TRANSFORMATION OF POLAR – INTO CARTESIAN COORDINATES
TRANSFORMATION INTO MISSILE – FIXED COORDINATES
ELECTRO – HYDRAULIC SERVO-SYSTEM
POSITION-INDICATOR

For the movement of the two beams, the $\beta$-$\zeta$ co-ordinate system has been chosen in order to avoid a singularity in the zenith. The beam transmitter is also movable about ($\alpha$), provided this is done before the missile is launched.

The control system of the missile, hereafter described, can provide for continuous accelerations very much greater than those possible with manned aircraft. Nevertheless, were appropriate provision not made, it would be quite possible to lose control of a beam-riding missile simply by moving the beam too quickly for the missile to follow it. (The beam can be thought of as being very similar to the light from a searchlight.) The Oerlikon beam transmitter is fitted with a special computing circuit which limits the maximum angular velocity and acceleration which can be applied to the transmitting aerials.

Two illustrations show the twin launching unit which serves to hold the missile in the required position for take-off. As can be seen from the specification, the launching acceleration is almost 3g, and this is apparently sufficient to enable the weapon to be fired into the guiding beam without the need for a lengthy ramp and (more surprisingly) without any jettisonable booster section. The missile is positioned in the launching cradle by hydraulic and pneumatic circuits, the operation of which is largely automatic. The loaded launcher is then elevated to the required firing angle by electrically controlled servo mechanisms.

The missile control system, already briefly described, requires a considerable array of airborne components housed within the missile itself. These are best tabulated as follows:—

(a) Aerials (either suppressed or flush with the missile skin) to pick up the microwave signals from the beam transmitter.

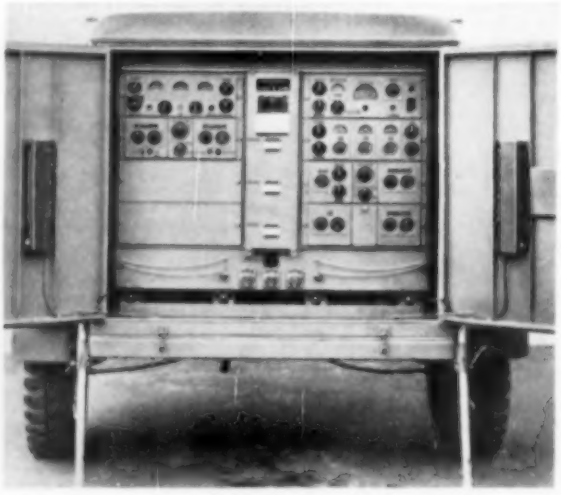
(b) A frequency separator to distinguish between the signals from the coarse and fine beams.

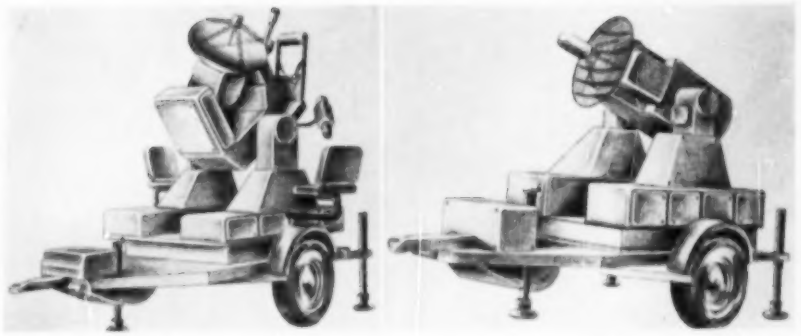
(c) Receivers for filtering and de-modulating the guidance signals.

(d) A coarse- and fine-beam receiver for amplification, regulation and de-modulation of the sub-carrier.

*The Type 54 missile is here shown about to be winched up along a ramp which places it in the right position for the catches to be engaged when the launcher is elevated.*

*This photograph shows the "business end" of the computor vehicle. The various items of equipment contained by this unit are described in the text.*





*These small sketches show the two main aerial vehicles, the battery radar tracker and (right) the beam transmitter. Both are neat, yet rugged, vehicles, able to go anywhere that wheeled traffic could be assigned.*

(e) A switching amplifier for automatically changing over from coarse to fine beam control and also for the transformation of conical into cylindrical co-ordinates and polar into cartesian co-ordinates.

(f) A computing amplifier and gyro assembly for the introduction of the steering coefficients as a function of time, for the transformation of space into missile co-ordinates to compensate for rolling and also for damping missile oscillations about the transverse axes.

(g) An electro-hydraulic servo system for steering the missile by deviating the thrust chamber and propelling nozzle and moving the fins.

(h) A source of auxiliary power consisting of a nitrogen-driven turbine and a synchro-generator.

Naturally enough, a guided missile is an extremely costly weapon and, in peacetime, it must be made recoverable wherever possible. The present Oerlikon Type 54 can, in fact, be recovered after test and troop-training flights, and for this purpose is arranged to break into two portions, each equipped with a parachute. At a pre-determined time after burn-out, the missile is separated into a forward portion, housing the electronic circuits, and a rear section accommodating the rocket motor. Each section is then allowed to fall freely, for a time depending upon the estimated burn-out height, in order to prevent the two sections from drifting over great distances. At a comparatively low altitude, the parachute in each section is streamed automatically.

To guard against loss of control of the missile for any reason whatever, it is possible to cut off the rocket motor by radio and effect emergency separation into the nose and tail portions with immediate deployment of the parachutes.

As might be expected, present missiles are fitted with a telemetering system, which supervises the steering and flight performance during test and training flights.

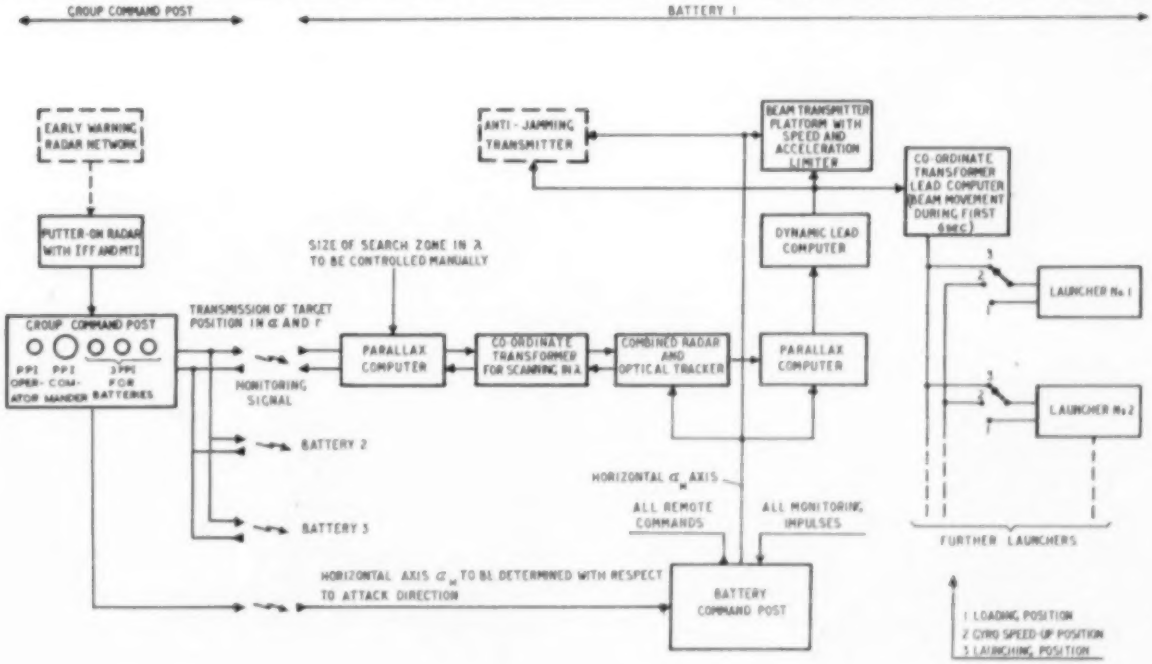
As already mentioned, the guidance of the powered part of the flight path is effected by deflecting the entire thrust chamber (and with it the propelling gas jet) with assistance from the four tail fins which are deflected simultaneously with the thrust chamber and thus produce the required turning moment about the centre of gravity of the missile. After burn-out, the propelling jet no longer exists, and all guidance has to come from the tail fins. The steering system is therefore so controlled that, at the moment of burn-out, the angular movements of the fins are considerably amplified.

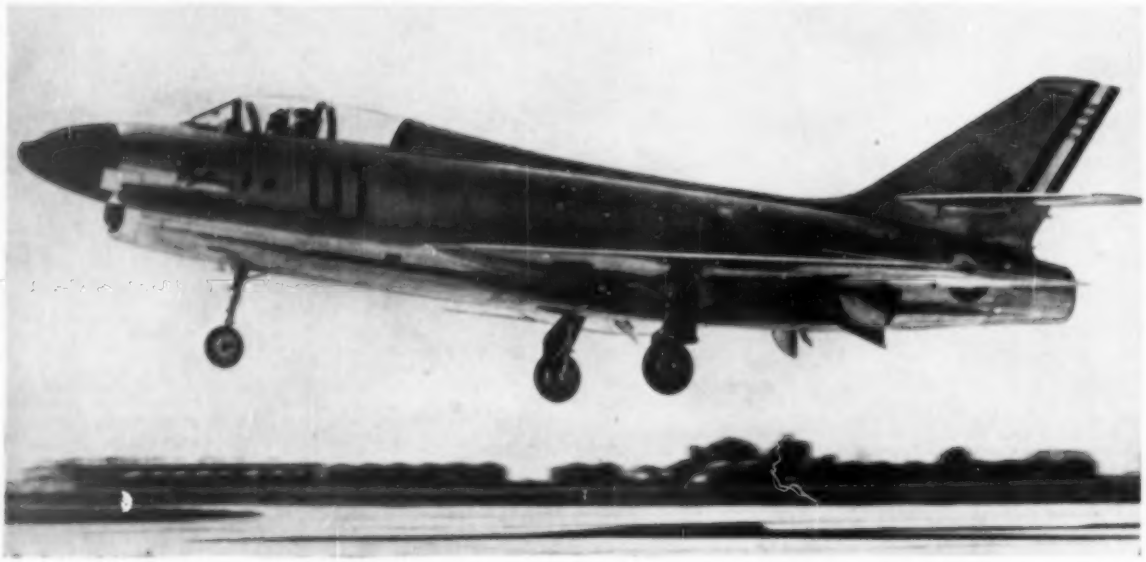
During flight, the delta-shaped wings are displaced longitudinally according to a pre-determined time programme, so permitting the steering ability of the missile to be maintained within the required limits in spite of the rapid changes in weight, lift and c.g. position. Rolling about the longitudinal axis is not prevented aerodynamically but is allowed for by making the characteristics of the steering mechanism such that rolling has no influence on the response of the missile to guidance commands.

It will be noted, of course, that the missile has cruciform wings of equal area (like all British missiles of which photographs have been revealed), and therefore it does not need to bank during turns.

The Oerlikon Type 54 missile, together with its ground equipment and the appropriate training devices, is reported to be in limited production for issue to specially formed anti-aircraft units of the Swiss Army. It is not stated whether the Swiss Government are prepared to export the weapon; if they are, it would seem that this will be the first missile capable of being bought "over the counter."

*An outline of the ground organization which would be employed in a defence system equipped with ground/air guided missiles of the Oerlikon type. The central group command post, on the left, would control three firing batteries of the type shown in the main part of the diagram.*


GROUP COMMAND POST
BATTERY 1
EARLY WARNING RADAR NETWORK
PUTTER-ON RADAR WITH IFF AND MTI
GROUP COMMAND POST
PPI OPERATOR
PPI COMMANDER
3 PPI FOR BATTERIES
TRANSMISSION OF TARGET POSITION IN α AND r
SIZE OF SEARCH ZONE IN λ TO BE CONTROLLED MANUALLY
PARALLAX COMPUTER
CO-ORDINATE TRANSFORMER FOR SCANNING IN λ
COMBINED RADAR AND OPTICAL TRACKER
MONITORING SIGNAL
BATTERY 2
BATTERY 3
ANTI-JAMMING TRANSMITTER
BEAM TRANSMITTER PLATFORM WITH SPEED AND ACCELERATION LIMITER
CO-ORDINATE TRANSFORMER LEAD COMPUTER (BEAM MOVEMENT DURING FIRST 6 SECS)
DYNAMIC LEAD COMPUTER
PARALLAX COMPUTER
LAUNCHER No 1
LAUNCHER No 2
FURTHER LAUNCHERS
HORIZONTAL α_M AXIS
ALL REMOTE COMMANDS
ALL MONITORING IMPULSES
HORIZONTAL AXIS α_M TO BE DETERMINED WITH RESPECT TO ATTACK DIRECTION
BATTERY COMMAND POST
1 LOADING POSITION
2 GYRO SPEED-UP POSITION
3 LAUNCHING POSITION



# ALL-WEATHER MYSTÈRE

## *French Transonic Two-seater Powered by an Afterburning Avon*

IT is now just six years since Avions Marcel Dassault began to develop a jet fighter. The first prototype carried the company type-number MD-450, and was named Ouragan (Hurricane). It was powered by a Hispano/Rolls-Royce Nene, and had a wing with slight sweep, rather like that of the Venom. The armament was four 20mm guns, and the limiting Mach number 0.83. During 1952 and 1953 a total of 350 Ouragans entered service with the French *Armée de l'Air*, and a further 71 were bought by India, with the name Toofani.

Logical development of the Ouragan involved increasing the sweep of the wing and increasing the power. These improvements led to the Mystère, versions of which have been powered with the Hispano Tay, Hispano Verdon, SNECMA Atar, Pratt and Whitney J48 and Rolls-Royce Avon. A very great number of different types of Mystère have already appeared, the two most important being the Mystère II C (Atar 101D) of which 150 are being bought by the French Government for the *Armée de l'Air*, and the Mystère IV A (Hispano Verdon) of which 225 are being paid for by an off-shore order by the U.S.A.F.

Production examples of both types of Mystère are now being delivered. It is to be noted that the report by U.S. Senators Stuart Symington and Harry Bridges describes the detail workmanship of the Mystère as being "far above the average" and "well up to the best American standards"—which becomes the more outstanding as one reads the Senators' comments on other manufacturers. Dassault have about 3,000 employees at plants dispersed widely throughout France. In addition, about 25,000 other personnel are employed on Mystère work among many sub-contractors. The only fly in the ointment from the production point of view seems to be that the Mystère (unlike, say, the Hunter) is by no means designed for mass-production.

The Dassault company have now produced an Avon-powered all-weather Mystère, designated Mystère IV N, which is illustrated here. The original Ouragans and Mystères were all day intercepters, but a number of prototypes were built with lateral intakes—and one with two seats—with a view to the eventual development of an effective all-weather machine. The IV N does not, in fact, have lateral intakes but employs a single straight-through duct passing under the cockpit, and first introduced on the similarly powered Mystère IV B.

The airframe of the IV N is essentially similar to that of the IV B, but about 4ft 7in has been added to the fuselage length to accommodate the navigator, seated behind the pilot. Both crew-members have a S.N.C.A.S.O. automatic ejection seat and the two cockpits are covered by a single sliding canopy. A very impressive fuel capacity is provided, there being virtually continuous tankage throughout each wing between the spars and further large tanks surrounding the centre-fuselage air duct and beneath the engine. The engine is at present a Rolls-Royce Avon RA.7R, but a variant of the Avon is to be licence-built by Hispano Suiza, and it is the latter engine (with a five-figure thrust) which will probably go into whatever IV Ns are ordered into production.

The front end of the new prototype bears a close resemblance to that of the F-86D Sabre, and it is reasonable to assume that it incorporates the American "two-dish" radar fire-control system carried by that aircraft. The armament itself is of unusual interest. A single 30mm cannon is carried on each flank of the forward fuselage, fed from a tank containing 100 rounds. These two guns fire out along blast channels formed by the re-entrant channel between the intake and the mould line of the nose. Directly behind the two ammunition tanks is a retractable container housing 52 unguided air-to-air rockets, which are rippled away automatically by the radar-ranging circuit. Four further rocket containers, each holding 19 missiles, may be carried under the wings.

All the primary control surfaces are governed by servo assisters, the overall response being of a very high order. The gaps between moving and fixed surfaces are extremely narrow and all balancing is internal. All Mystères are fitted with an automatic stabilizer and yaw-damper,

FASTEST FARTHEST HIGHEST

Efficiency and Safety

VICTOR

With engines buried in the highly-swept inner wing, air resistance is reduced to a minimum. Their location behind the load-bearing structure reduces the hazard of engine fire.

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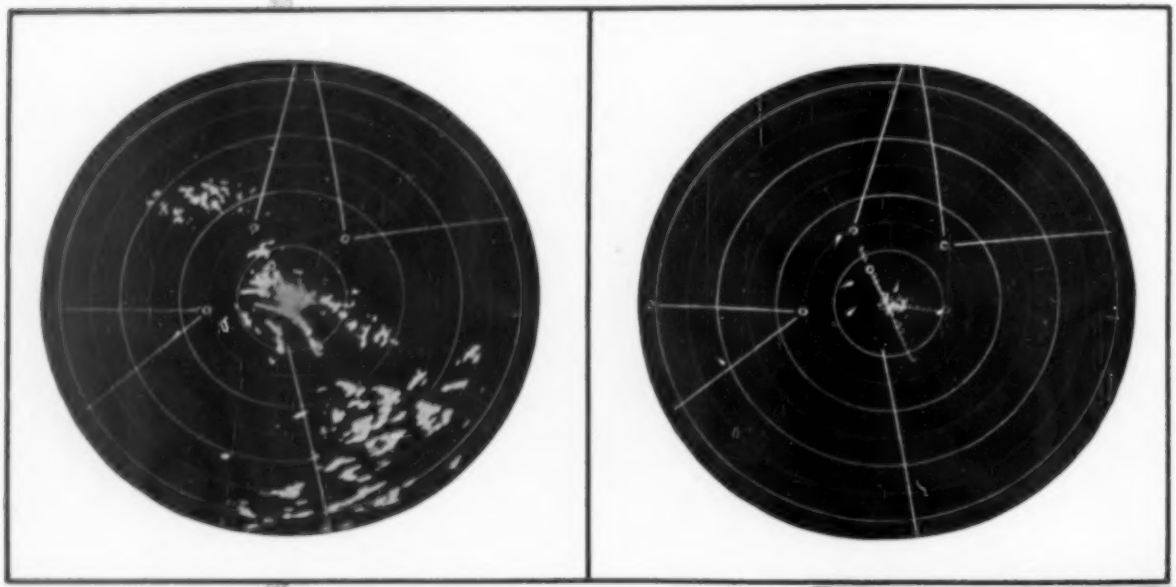
FASTEST FARTHEST HIGHEST

# COSSOR ENGINEERS MOVE THE ALPS

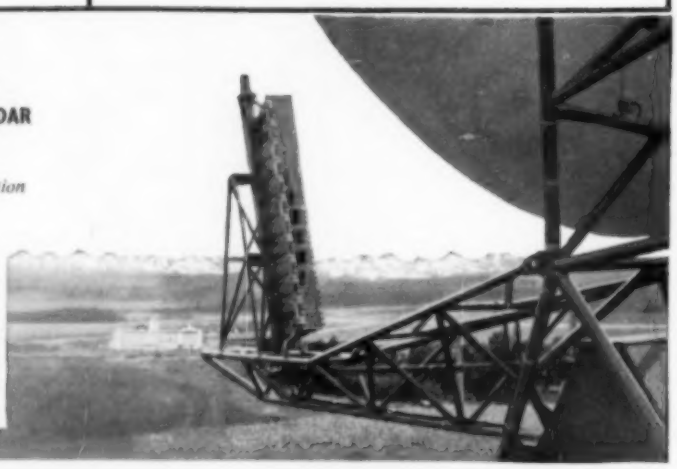
These two 40-mile range PPI photographs were taken on the Cossor Airfield Control Radar Mk. VI now installed at Zurich, Switzerland. That on the left is the normal radar display. The other PPI (right) shows clearly the effectiveness of the Cossor developed PERMANENT ECHO CANCELLATION circuits; the moving aircraft responses previously obscured are now revealed. Mountainous terrain such as is found in Switzerland, with saturation ground returns, has hitherto been a nightmare for radar operators. Cossor engineers specialize in advanced development of this kind and have produced

THE FINEST CONTROL RADAR—ACR MK. VI BY COSSOR.



**COSSOR AIRFIELD SURVEILLANCE RADAR (ACR Mk. VI)**

*A view of the installation at Zurich Airport.*



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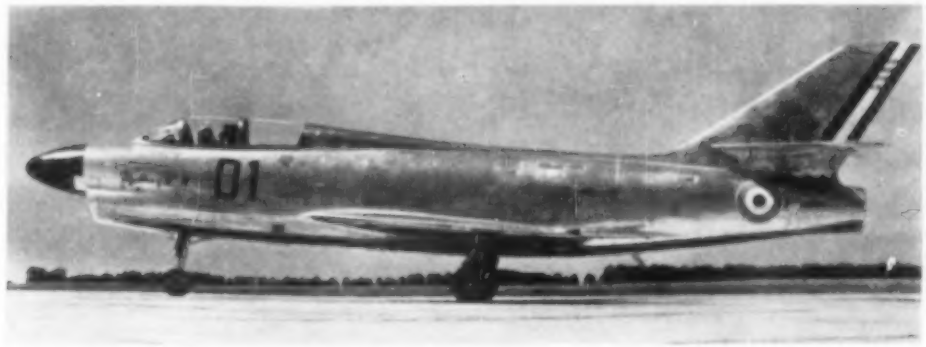


*The side view on the left shows the great size of the Mystère IV N fuselage, and also suggests that the tiny nosewheel must bear a load out of all proportion to the tyre size. The lower view emphasizes the similarity to the F-86D, which even extends to the details of the nose undercarriage and doors.*

## ALL-WEATHER MYSTÈRE . . .

this being either British (Elliott Brothers) or of French origin (S.F.E.N.A.). Control in the pitching plane is provided by an all-flying tail, and it is probable that production IV Ns will have a one-piece tailplane of the "slab" type (i.e., no separate elevators). Spring tabs are not fitted, these being—in the opinion of most engineers—undesirable devices for modern fighters.

Although the Mystère IV B has reached the speed of sound in level flight, this achievement has not so far been realized by the larger IV N. At the present time, it appears that the IV N has a limiting Mach number of about 1.21, reached in a 20 deg dive, and the maximum level Mach number is probably about 0.97. Several important calculated performance figures will be found in the table below. The actual realized figures, although not yet released, should not differ greatly.

The prototype Mystère IV N first flew on July 19th last year and has now completed about 50 flights totalling considerably more than 50 hours. It finished its trials at the Centre d'Essais en Vol at Brétigny (roughly equivalent to our Boscombe Down) last month and has now returned to the Dassault flight-test establishment at Melun-Villaroche. In intervals between serious testing, a number of distinguished passengers have been carried, and an account of a ride given to the French Air Minister, M. Catroux, was published in our issue for November 12th last.

Taking an overall view of the aircraft, the Mystère IV N appears an unusually interesting solution to a difficult problem. It is, of course, only natural that Dassault, having a sound and well-tried basic design, should try to "stretch" it to the utmost. Time will show whether or not the IV N is a good and usable all-weather machine.

Throughout the history of the development of Dassault fighters the influence of North American Aviation can be seen in each succeeding prototype. North American's all-weather Sabre, the F-86D, is a single seater. This was made possible largely through the adoption of an immense array of automatic control systems; even so, navigation of the F-86D remains a slight problem. The French designers seem to agree with our own that an all-weather fighter requires a second crew-member; it does appear, however, that the IV N is about as far as anyone would care to go in "stretching" the Mystère design, short of incorporating a wholly new wing (the latter is, in fact, being done). A glance at the photographs indicates that the tyre pressure must be high.

Even allowing for the valuable emergency thrust of the Avon

and afterburner, the weight of the Mystère seems to have risen in greater proportion than has the power. The fuel tankage, for example, has increased until, in this latest machine, it totals no less than 1,100 Imp. gals. The overall impression that the aircraft gives is, therefore, that it would be a better aircraft with rather more wing, although it should not be any more difficult to handle than other fighters of comparable performance.

The best feature of the aircraft is that nearly all its equipment has been tried and fully proved. If it were ordered there seems to be no reason why squadrons should not be formed within a year. The final answer is probably provided by the recent off-shore purchase of the Gloster Javelin—a machine designed for a similar task, but tailored to the job from the outset.

**DASSAULT MYSTÈRE IV N**

**(Rolls-Royce Avon RA.7R (9,500 lb thrust) or, later, S.N.E.C.M.A. Atar 101 G-21 or a later model of Avon)**

Span, 36ft 5in; length, 48ft 7in; height, 15ft 3in; gross wing area, 344.5 sq ft; quarter-chord sweep, 38 deg; thickness/chord ratio, 7.5 per cent; dihedral, — 1 deg 30 min; track, 10.6ft; empty weight, 15,400 lb; all-up weight without underwing load, 23,060 lb; wing loading 67 lb/sq ft.

**Performance:** Maximum level Mach number, 0.97; limiting Mach number, 1.21; maximum speed at sea level, 630 m.p.h. (547 knots); maximum speed at 12,000m (39,370ft), 569 m.p.h. (494 knots); landing speed, 144 m.p.h. (124 knots); take-off over 50ft, 3,180ft; landing over 50ft, 5,250ft; climb to 39,370ft, 5 min 20 sec (with afterburner); normal duration, 1 hr 45 min (max. duration 3 hours with 1,100 gals).

## CAPT. PRITCHARD'S AMERICAN TOUR

IT is learned from the Royal Aeronautical Society that Capt. J. Laurence Pritchard, a member of its council, is to give a series of lectures to engineering students and graduates at a number of American universities, and to sections of the Institute of the Aeronautical Sciences.

He will lecture on the history of the R.Ae.S. and its relationship with American individuals and organizations during the last 80 years; on *The Wright Brothers from the British Point of View;* and on *The History of British Aviation between 1804 and 1954.*

Capt. Pritchard's schedule includes attendance at the Conference on High-Speed Aeronautics, the celebration of the centenary of the Polytechnic Institute of Brooklyn, the Honors Night Dinner of the Institute of the Aeronautical Sciences, and lectures at the universities of Johns Hopkins, Princeton, Cornell, Michigan, Purdue, Illinois, Colorado and California; at the Massachusetts Institute of Technology, the Polytechnic Institute of Brooklyn, the State Colleges of Iowa and Mississippi; and at the California Institute of Technology.

He is also expected to give the opening lecture in Vancouver on the occasion of the founding of a branch of the Canadian Aeronautical Institute, and to spend a week in the Library of Congress at Washington, to study correspondence of the Wright Brothers with members of the Royal Aeronautical Society.

Capt. Pritchard is to sail on January 10th, and expects to be back in England in the middle of April.

## GANNET TROPICAL TRIALS

COMPREHENSIVE hot-weather trials of the Fairey Gannet, at Khartoum, were recently completed in less than a month. The object was to test the Double Mamba engine under operating conditions for any part of the Mediterranean area, and two identical engines were used, in order that results could be cross-checked.

On the return flight from Khartoum, deck-landing trials took place in the Mediterranean on the light fleet carrier H.M.S. *Albion*. This is the first time an angled deck carrier of this class has been available for comprehensive deck tests by the Gannet, and trouble-free landings and take-offs were reported.

Service flying with the Gannet, and deliveries of production aircraft to the Royal Navy, have been fully resumed following modifications to the Double Mamba.

# HIGH-LIFT GENERATION

PART 1

By A. R. WEYL, A.F.R.Ae.S.

THE application of high specific-lift forces which aerofoils may produce is still in its infancy, and for this our obsession with speed is responsible. However, the rising demand for imperfect, uneconomical and complicated machinery, such as is represented by the modern helicopter, is proof of the existence of vast fields which require development.

Before we go into the wide and important subject of aerofoil lift regardless of drag, certain conceptions need clarifying.

**Lift Coefficients.**—Aerodynamically, lift (or cross-force) is normal to the direction of motion. Under certain conditions, however, aerofoil lift can be generated without forward motion. In such cases, lift can be any air force which opposes gravity. In these instances, also, the usual definition of "lift coefficient" loses its sense, and a different basis must be adopted.

Lift coefficients are often victims of fallacy or deception. In practical flying, the maximum lift coefficient is derived from a stalling speed and referred to a standard wing area, regardless of whether chord-extending flaps or other slow-flying devices actually increase the effective wing area. So far as achieved values of the maximum lift coefficient are concerned, these associations cause confusion.

Aircraft manufacturers, eager to sell their products as miracles of low-speed performance, are alive to the fact that accurate determination of a stalling speed is beyond the scope of the ordinary customer; they prefer to quote "landing" speeds and the indication of airspeed indicators. A landing speed is a measure made of rubber. It allows the production of synthetically enormous $C_{Lmax}$ values, aided and abetted by a shrewd choice in positioning the pitot head of the A.S.I. Thus a plain wing which, at its best, could have a maximum lift coefficient of 1.6, has been credited with one of not less than 6 (a value hitherto never achieved in practical flight).

On the other hand, many modern aircraft do not even achieve, during take-off and landing, the modest $C_{Lmax}$ values with which the labours of aerodynamicists have provided them. This is simply by reason of imperfect design features, such as lack of control power in the low-speed range, or because of deficient stalling qualities. We are still in the unfortunate stage where the incidence of the maximum lift and that of incipient stall are close together, and often so close that they practically coincide. This does not apply only to certain wing shapes and notorious aerofoil sections; most commonly employed high-lift devices suffer from it.

**High Lift.**—The generation of very high lift is linked with the occurrence of high drag forces. Even if it were possible to keep the profile drag low (and there is little prospect of this) the induced drag increases with the square of the lift coefficient. Since the finite span of a wing would also decrease the lift, because of pressure equilization over the tips, design features such as end discs, fences, curtains, etc., have to be applied in order to utilize fully the benefits of very high lift coefficients; these features add to the drag.

As the drag force depends upon the square of the flying speed, a high drag coefficient means little at low speeds, and during vertical take-off and landing nothing at all.

At a lifting aerofoil, the air assumes velocities of flow which differ from that of the forward speed of the aircraft. Along the dorsal surface the air has greater velocity, along the ventral surface lower velocity. This is the result of the superimposition of the undisturbed free-stream flow of air by a circulatory flow around the aerofoil section (Fig. 1). This "circulation" causes velocity and pressure differences at the aerofoil surface (Fig. 2) and hence is responsible for the lift.

To set up a lift-producing circulation, the aerofoil must either be asymmetrical in its section or have an incidence against the undisturbed direction of flow. Asymmetry is expressed as camber of the aerofoil centre-line, and camber without incidence is capable of producing lift. With a symmetrical body, such as a circular cylinder, circulation can be induced and/or sustained by rotating it in a fluid stream (Fig. 3). This is genuine "rotor" lift (Magnus effect). For high lift, wings normally make use of camber and incidence combined. In conjunction with symmetrical aerofoil sections, a deflection of flaps gives the effect of camber lift.

For most of us "circulation" implies something connected with

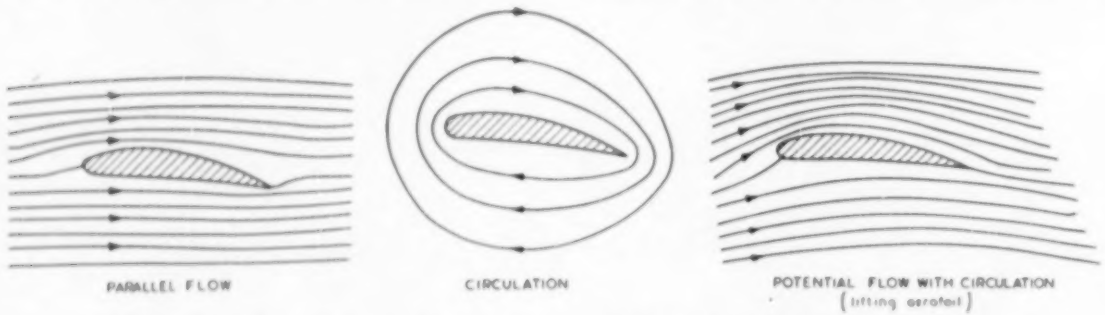



*Fig. 1. Generation of lift in potential flow, from the superimposition of a parallel flow with a circulation.*

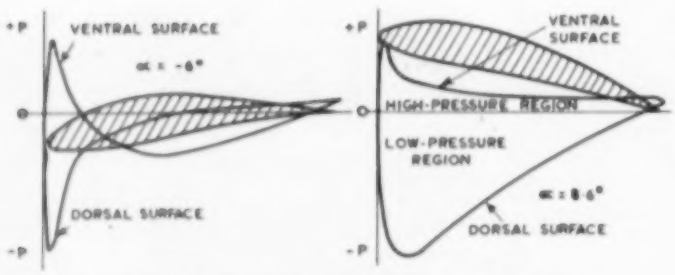



*Fig. 2. Distribution of pressure around an aerofoil section.*

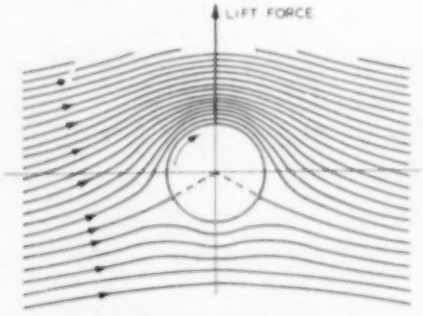



*Fig. 3. Rotating cylinder in inviscid flow.*

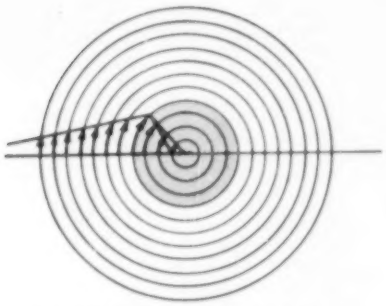


Fig. 4. Velocity distribution in a vortex.

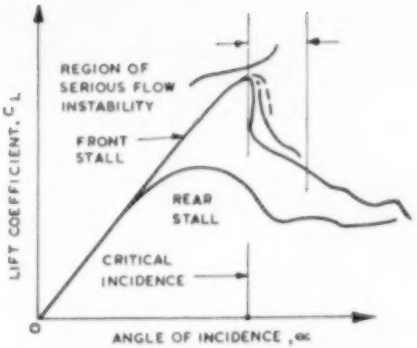



Fig. 6. Front stall and rear stall.

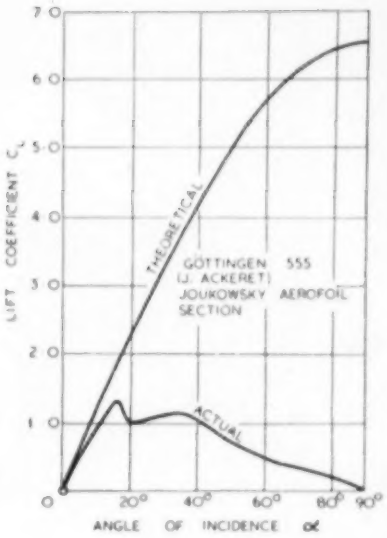



Fig. 5. Starting vortex which induces circulation on wings.

Fig. 7. Aerofoil lift, in the theory of potential flow and in practice.

newspapers, money or film stars, and a term like "vorticity" perhaps suggests the horrors of mathematical symbols. Hence it is useful to understand what is meant by the statement that "circulation is an irrotational vortex, the core of which is formed by the aerofoil," and that "irrotational" implies zero vorticity, both characteristic properties of potential flow. Anyone enjoying the use of a bath-tub has noticed the odd flow motion set up in the water as soon as the plug is withdrawn. This is a vortex forming over a "sink" (which is a learned expression for the drain hole). Similar flow motions exist in the air, as we see from the play of leaves within miniature tornadoes around sheltered corners. A handy hydrodynamic experimental ground (preferred by Civil Servants and the like), namely, a stirred cup of tea, discloses that the circulatory motion has a velocity distribution resembling that indicated in Fig. 4. Such vortices are irrotational because the fluid mass moves as a whole, no element of it turning about its own axis. In a turbulent flow, however, vorticity is present: fluid particles whirl about in a disordered manner. Viscosity is at the root of such disorderly behaviour, and flow within a boundary layer may behave like this. But our circulation is irrotational, and therefore not turbulent.

Circulation alone is incapable of producing lift: a rotating cylinder induces lift only when moving through the air or when exposed to an air stream.

We must also refer to the boundary layer, which is a physical fact and not fiction for the exercise of advanced mathematics. Air has little viscosity, and all that there is of it plays its part within the boundary layer which enshrouds any body that is immersed in an air stream. In respect of high lift, a boundary layer is a Jekyll and Hyde. Without it, circulation cannot be induced, because the vortex starting it is formed from boundary-layer material which is shed as a "vortex sheet" from the wing (Fig. 5). But separation of the boundary layer from the dorsal surface of an aerofoil is the reason why the theoretically predicted lift of potential flow is not attained, and why we experience stalling (Fig. 6). Actually, potential-flow theory promises very high lifts ($C_{L\max}$ values of between 6.3 and 12.6 respectively), and no stall for incidences of up to 90 deg (Fig. 7). Without a boundary layer, we would obtain that.

As commonly known today, a boundary layer may flow in two differing states. If it flows in a laminar state it gives minimum profile drag, but it is also likely to reduce the lift and to snap into separation (the abrupt stall). If it flows in a predominantly turbulent state, it adheres much better to the aerofoil surface, even against an adverse pressure-gradient; higher maximum lift and a gradual stall are the consequences (Fig. 8). At the "transition

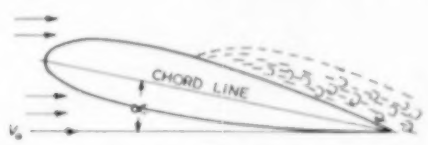



Fig. 8. Modification of hydrodynamically effective aerofoil section, caused by partial boundary-layer separation at incidences near the complete stall: beginning of the lift decrease.

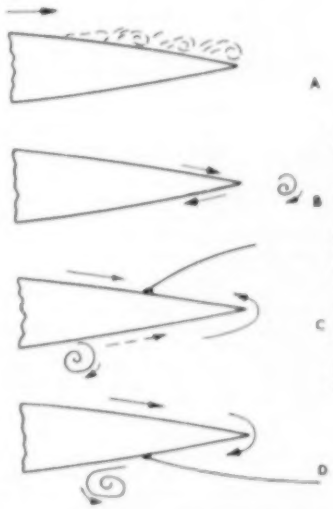



Fig. 9. Influence of a sharp trailing edge upon the circulation.

A = Boundary-layer separation and formation of circulation-reducing vortices.

B = Satisfactory flow at naturally induced circulation, with vortex formed as a result of abrupt velocity gradient in the boundary layer.

C = Circulation weaker than the naturally induced strength (stagnation point forward on dorsal surface).

D = Circulation in excess of natural strength (stagnation point forward on ventral surface).

point," the state of flow within the boundary layer is supposed to change (in reality, this takes place along a distance). Merry games are played between it and the separation point, with profound consequences on the low-speed flying characteristics of the aircraft.

The lift coefficient is determined by the strength of the circulation, i.e., by the mean velocity of the revolving air mass. This, in turn, depends upon camber and incidence. For any given incidence and camber, the circulation limit is imposed by the trailing edge (Fig. 9). In practice, it is, alas, even less. The reason for such influence by the trailing edge is that it is the point at which the flow separates from the wing. The trailing edge is (or should be) a stagnation point at which, relative to the wing, the air is at rest. Another stagnation point is at the leading edge.

If the trailing edge were not a stagnation point, the circulation would cause air to flow around the trailing edge. Theoretically, in an inviscid fluid, this cannot happen, since any flow around a sharp corner implies infinitely great flow velocities, physically an impossibility. In practice, however, the viscosity of the air and the presence of a thick boundary-layer at the trailing edge modify this to some extent. In most cases, separation actually takes place somewhere in front of the trailing edge, on the dorsal surface. This reduces the lift against the value of the theoretical one. Some flow around the trailing edge is thus possible, and there is no need to make this region needle-sharp.

Cutting off the trailing edge and rounding the rest renders the circulation theoretically indeterminate (Fig. 10). In practice, no more than an increased profile drag is experienced. If we now use subterfuges to speed the circulation to more than the theoretical

## HIGH-LIFT GENERATION . . .

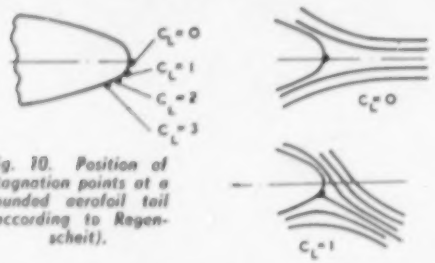



*Fig. 10. Position of stagnation points at a rounded aerofoil tail (according to Regenscheit).*

lift limit, the excess lift becomes independent of incidence and camber; it is then termed "forced" or "supercirculation." At present, no use is made of it.

Supercirculation is characterized by flow around the aerofoil tail end. This flow is opposite to that described in connection with defective circulation, and is always in the sense of the circulation. Hence the aft stagnation point approaches the front one along the ventral surface. In practice, supercirculation is generally not compatible with a sharp trailing edge; the latter counteracts and destroys supercirculation. This has been the cause for the failure of many attempts to achieve high lift in a practical way.

**Slow-flying, Direct-lifting Aeroplanes.**—To develop aeroplanes which are capable of competing with the helicopter, three requirements will have to be satisfied:—

(1) High specific lift.
(2) Abolition of the stall, or, at least, incidence of incipient stall remote from operational maximum lifts.
(3) Lift generation at zero forward speed.

It can be shown that these three requirements are not beyond our reach. Aeroplanes with such features will, of course, be rather different from the customary high-speed type; and, in many ways, basic research is involved.

*(Part 2 will be published next week)*

# TV's AIR WAR: JAPAN AND GERMANY

"THE control of the air precedes control of the sea" was the maxim with which the Japanese entered the war in 1941. This phase was covered by *The Rising Sun*, Episode 7 of the B.B.C. Television film, *War in the Air*.

The effectiveness of the maxim may be judged by the fact that within five months the Japanese were masters of the East. Sunk were the mighty British warships *Prince of Wales* and *Repulse*, protected by destroyers but not aircraft; lost was Hongkong, the air defence of which was pitiful; lost, too, were Singapore and the rich islands of South East Asia from which Britain had been drawing vital sinews of war.

The film included many interesting sequences of captured film depicting enemy air activity, particularly shots showing preparations for and taken during the attack on Pearl Harbour. Aichi Val (Navy 99) dive-bombers and Nakajima Kate (Navy 97) torpedo bombers were shown taking off from some of the six carriers taking part in the attack, together with Mitsubishi Zeke (Navy 0) fighters fitted with long range tanks. The extreme manœuvrability of this fighter—the famous "Zero"—was one of the many unpleasant surprises that the Japanese sprang on the Allies from that fateful December 7th onwards.

By May 1942 the Japs were advancing across Burma towards India—the right claw of a gigantic pincer movement designed to meet Rommel's Afrika Corps in the Middle East. Opposing them were but *thirty-seven* operational aircraft! Throughout India there were only four R.A.F. operational groups, though with reinforcements coming in slowly a start was made to build our strength up to six groups, the five squadrons to 26. The arrival of Spitfires was depicted in the film and their rôle—reconnaissance—stressed.

The value of reconnaissance was proved when, on Easter Sunday, 1942, the Japanese struck again; this time at Ceylon. First spotted by Catalinas, the Japanese carrier-borne force received such a hot reception from the guns of the Far Eastern Fleet and the few aircraft (Hurricanes) available that they turned tail, losing many valuable pilots in the process. This important attack has not been publicized before and one would have liked more details and a balance-sheet of the results.

After Ceylon came the great battle of the Coral Sea, notable because it was the first naval action in which opposing ships did not sight each other, each side striking with aircraft, while the other was still below the horizon.

In June the Japanese turned to attack Midway Island with a very strong force of five carriers (including four that took part in the attack on Pearl Harbour) and seven battleships, supported by cruisers and destroyers. Once again Allied reconnaissance aircraft denied them the element of surprise and, in the laconic words of an American officer "The Nips lost a hell of a lot more than we did, and beat it back home." Japanese losses were, in fact, four carriers and one cruiser, while the Americans lost the carrier *Yorktown*. This battle was depicted with several spectacular shots of Japanese aircraft being shot down by heavy anti-aircraft fire—scenes certainly emphasizing the value of having trained ciné-cameramen available on such occasions.

The outstanding feature of the film was that air control was exercised on both sides almost entirely by carrier-borne aircraft. By this time the aircraft carrier had become the capital ship of the Allied fleets; the Allies had learnt their lesson from the Japanese.

This film must have given many viewers the chance of a direct comparison with the American film *Victory at Sea*, which, televised two years ago, covered the same actions. The earlier film devoted no fewer than four episodes to the events covered in *The Rising Sun*.

It is thus obvious that events were covered much more briefly in the British film. Thus, the battle for Midway Island—one of the most decisive in naval history—was almost glossed over. In the earlier film it occupied the best part of an entire episode and full details were given of the rôle and order of attack of the B-17s, Avengers and dive-bombers used in the U.S. attack. In *The Rising Sun* tantalizingly brief glimpses were shown of interesting types such as three stubby Martin 166 twin-engined bombers in formation, Nells (Navy 96) attacking Singapore, a Pete (Navy 0) floatplane catapulted from a ship, and a Japanese pilot, complete with sword, clambering into his aircraft.

Many of the shots were so brief that only the most expert of spotters, or those having previous knowledge of the types used in the actions, could have identified the aircraft seen, with any degree of certainty.

**Air Power Over Germany.** In 1940 the Luftwaffe sowed the wind; but by 1943 it was Germany that was reaping the whirlwind. This was graphically illustrated in *Round the Clock*, Episode 8 of the film. Probably the best of the series so far, this instalment carried on the story of the bombing of Germany from Episode 4 up to the beginning of 1944.

Brief descriptions of the bad-weather radar aids $H_2S$ (self-contained, and used for the general location of targets) and Oboe, (much more accurate and used by the Pathfinders to indicate the actual targets) were given—descriptions which must have been of great interest to those who knew them only as secrets.

The film covered the work of Bomber Command and the U.S. 8th Army Air Force by showing sequences depicting a typical raid by each force. The Met. recce, by Mosquitoes of the Pathfinder Force, which preceded each R.A.F. raid, was shown; there followed briefing instructions, Lancasters bombing up with 8,000 lb block-busters, the take-off at dusk, brief shots of German night fighter pilots scrambling and, finally, aerial views taken over Essen during an attack by 400 "heavies."

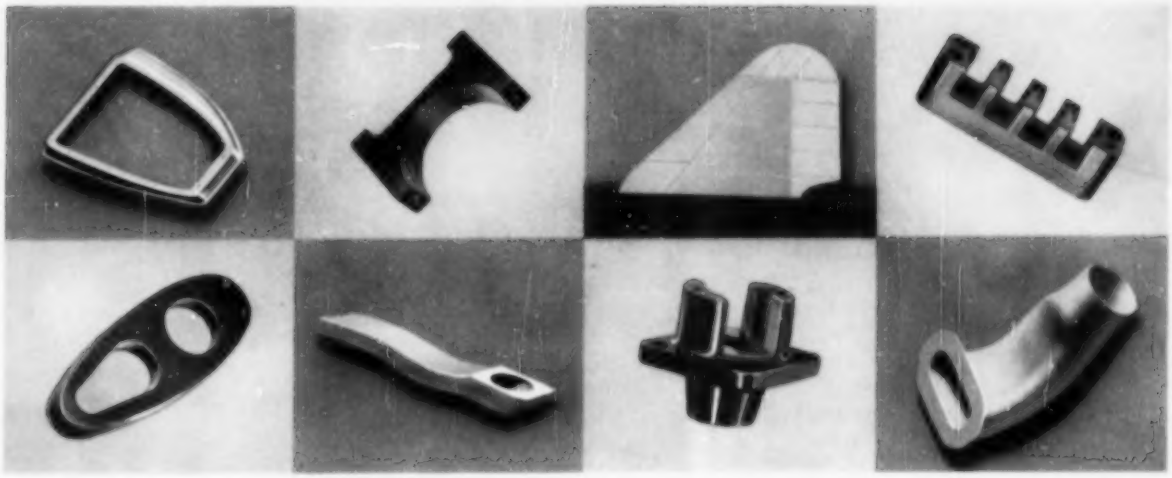
Bomber Command's specialized attacks on selected targets of strategic importance during this period were epitomized by the famous raid on the Moehne and Eder dams. Torpedoes could not be used as the dams were protected by steel netting, and the use of the special "skipping" mines developed by B. N. Wallis was revealed for the first time. The training sequences and "stills" shown were genuine, but shots depicting the raids were taken from the film *The Dam Busters* (not yet released).

The daylight attacks by the U.S. Army Air Force were aimed mainly at the whittling down of enemy fighter strength, whether in the air, on the ground, or under construction. American losses were heavy and, by 1943, long-range fighter escorts were provided whenever possible. Me109s and Fw190s were shown taking off to intercept the B-17 Flying Fortresses and B-24 Liberators, as the Luftwaffe attempted to repeat the success of the R.A.F. during the Battle of Britain. The camera-gun shots taken during the ensuing air battles were some of the clearest so far seen in the series. Easily identified was an Fw190 being shot down; a B-17 attacked from astern, catching fire and falling to pieces; a P-47 Thunderbolt after an Fw190; an Me109 rolling smoothly after one wing had been shot off; and, most spectacular of all, a head-on attack on a B-17, the hits from the attacking fighter's cannon being easily visible.

The shooting-up tactics of the escorting fighters on the way home included many camera-gun shots of aircraft being straffed on the ground, trains blowing up, and a spectacular shot of an Fw190 exploding over an airfield.

This was the pattern of the Allied air onslaught against Germany, and which by 1944 had laid waste some 30,000 acres in 50 towns. Even so, German output of arms was actually higher than it was at the beginning of 1943. But this was not to last. Germany was on the defensive, and the Battle of Berlin was about to begin.

M.F.A.



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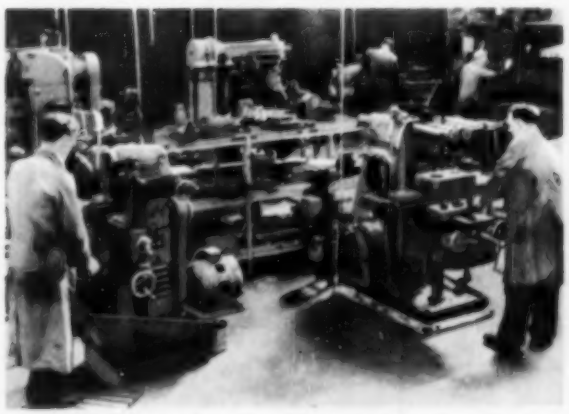

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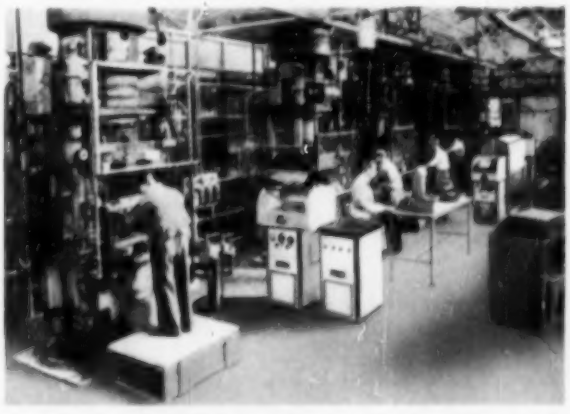

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DE HAVILLAND

# AIRCRAFT INTELLIGENCE

*A recent flight view of the Leduc O.21 ramjet aircraft. A note appears on this page.*

### U.S.A.

*Hughes XH-17.* After being two years grounded the great Hughes XH-17 single-rotor helicopter has taken the air once again. The U.S.A.F. has approved further testing of an anti-vibration measure, and it is reported that the craft has hovered for several minutes at about 25ft.

*Jacobs Helicopters.* Formerly known as makers of radial air-cooled engines, the Jacobs Aircraft Engine Co. is now engaged on helicopter development, and is reported to have negotiated for the building of Napier Oryx gas producers (and possibly larger derivatives) under licence. The Model 104, at present under development, has a Jacobs R-755-EH piston engine of 350 h.p.

*Grumman S2F Transport.* Now imminent are test flights with the first transport version of the Grumman S2F twin-engined anti-submarine aircraft. This model will be quickly convertible to carry either eight passengers or more than 1,600 lb of freight, and will replace the TBF Avenger torpedo bombers now used on the "codfish" airline, which maintains communications between aircraft carriers at sea and shore bases.

### France

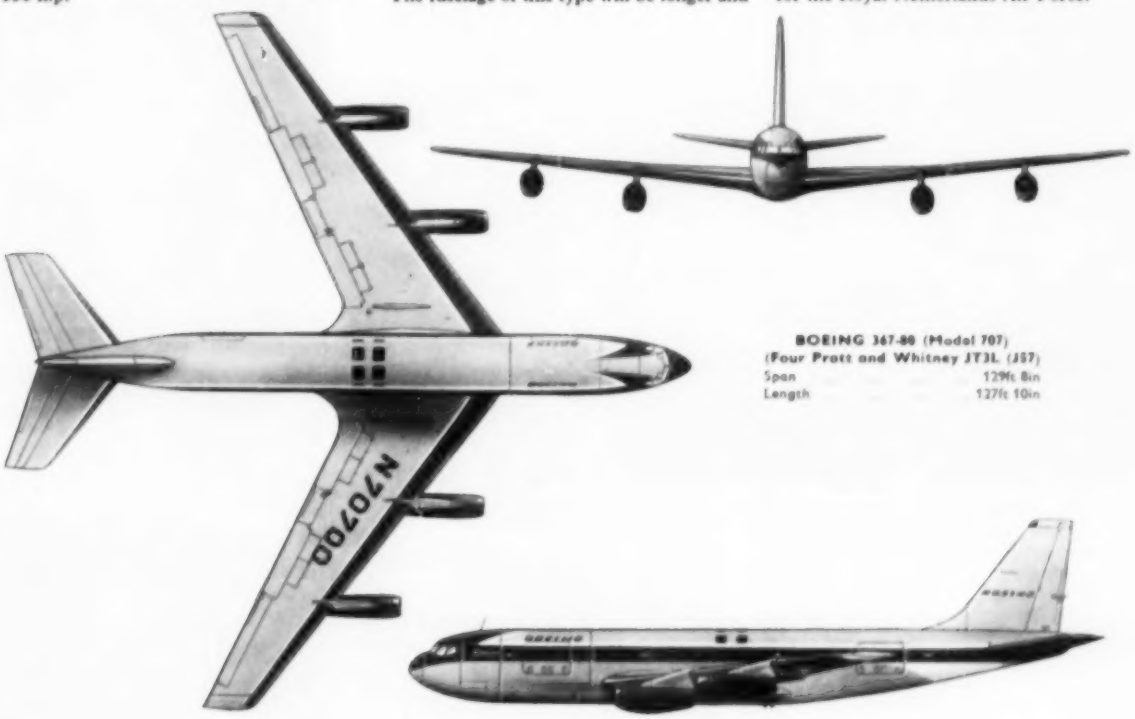
*Leduc Developments.* The French designer Leduc has announced that the first of his two prototype O.22 ramjet aircraft will be flying during the early summer. The fuselage of this type will be longer and more cylindrical than that of the O.21, illustrated on this page, and the ramjet will develop a thrust of about 60 metric tons. It is hoped that this will enable the aircraft to maintain a constant Mach number during any evolution, but additionally there will be a S.N.E.C.M.A. Atar turbojet mounted in the middle of the body "to ensure take-off." The wings will be swept back and will carry fuel tanks at the tips, the total fuel weight being 30 per cent of the all-up figure. The design Mach number of 2 should be maintained on the climb. According to M. Leduc, the most modern type of bomber, flying at 49,000ft, could be intercepted in less than three minutes—this time including the start-up and ground-run periods.

*S.O.1221 Djinn.* Some impressive Alpine flights have been made by this little helicopter. Carrying two persons, trips were made between Mount Geneva and the summit of Mount Chaberton, which is over 9,800ft high. Under official observations the Djinn took off easily under standard conditions with a total load exceeding 1,540 lb, which means that it is able to carry more than 125 per cent of its own weight.

*Breguet* 901. This world-champion sailplane has now been ordered into series production. Sixty machines will be produced for French users, and numerous improvements will be incorporated, not only to increase efficiency, but to lower the price. Plastics will be used for certain components. A small number of additional 901s will be built for export and should find a ready market.

### Italy

*North American F-86K.* April is the scheduled month for completion of the first Fiat-built North American F-86K Sabre single-seat all-weather fighter. Additionally, a "substantial number" of F-86Ks are being built for NATO countries at the Inglewood factory of North American Aviation Inc. Of these, 56 are destined for the Royal Netherlands Air Force.




**BOEING 367-80 (Model 707)**
**(Four Pratt and Whitney JT3L (J57)**

| | |
|---|---|
| Span | 129ft 8in |
| Length | 127ft 10in |

*Autocar and Dragonfly at the Aurukun Mission, where they had arrived with witnesses for a murder trial.*

*Autocar on the beach at Port Douglas, whe*

# BUSH PILOT'S

**IN his recent Commonwealth and Empire lecture, the Duke of Edinburgh laid particular emphasis on the "outback" services in the Northern Territory of Australia. Pilots engaged on these services, said the Duke, were doing by air, with added difficulties, what the carriers and bus drivers were doing in the rural areas of Britain. A clear impression of the nature of this outback flying is given below by an Australian bush pilot of great experience. During the past 15 years Mr. Roche has operated from every state in Australia. He and his wife—an ex-A.T.A. pilot with over 1,000 hours to her credit—are members of Bush Pilots Airways Pty., Ltd., which is equipped with a D.H. Dragon and Dragonfly (one of the few still flying), a Cessna and an Auster. Mr. Roche is also chief pilot to the Queensland Ambulance Transport Brigade.**

TO pilots used to flying in Great Britain and Europe, where there are abundant airports, radio aids, roads, railways and cities, outback flying in Australia must seem like something from the horse and buggy days. Actually, although a little primitive at times, it is nevertheless an absorbing and fascinating job.

For some years past I have been flying in far northern Queensland, over an area of, roughly, two hundred thousand square miles —which, if my memory serves me correctly, is bigger than the area of Great Britain. In all this vast area, with the exception of several small cities on the coast, there are not more than a dozen tiny ghost-towns, relics of the roaring gold mining days. Most of the flying is from homestead to homestead.

The country is tough and rugged and varies enormously in character. On the coast there are long golden beaches, towering mountain ranges, dense tropical jungles, and miles of snow-white sand dunes. Farther inland are areas of rocky basalt country, almost bare of vegetation; the grassy plains adjoining the great rivers; and the dead eroded hills and barren deserts of the Mount Isa area. From the Gulf of Carpentaria, right up the Peninsula, the country is heavily timbered, swampy and crocodile-infested.

All the aircraft flying over this area are based at Cairns, the northernmost city in Queensland. Beautifully situated on Trinity Inlet, this city of over 18,000 inhabitants is ringed on three sides by heavily wooded mountains whose peaks rise to over 4,000ft. This chain, which rises abruptly from the sugar-cane fields, about two to three miles behind the city, stretches inland in places for a distance of over sixty miles. After take-off from Cairns one nearly always has to circle for sufficient height to clear this range; and in the summer-time, when the density altitude is high, I have on

*This 1937 Cessna four-seater, originally owned by the author, now operates as an ambulance from Hughenden, about 100 miles west of Townsville.*

*(Right) Cairns Airport, the centre of the flying ambulance service described by the author. A 1,000ft slope overshadows the main runway.*

, where it landed to pick up a patient.

The Dragonfly, one of the few still in service, is seen over bush near Coen.

# ALBUM

BY FRANK ROCHE

numerous occasions been forced to resort to glider technique and go cruising round the lower ridges looking for a thermal.

After crossing the coastal range the terrain gradually flattens out into the great outback cattle country. In places one can fly over a hundred miles, without seeing the slightest vestige of habitation. As can well be imagined, airstrips are few and far between, and a forced landing in these parts is to be avoided. In this inland country the great problem is not so much a matter of getting down without serious injury, as of surviving until assistance arrives. Under this tropical sun a man without water can perish almost in a matter of hours.

Apart from hunger and thirst, other hazards that must be faced by the grounded airman are attacks by dingoes (wild dogs), wild pigs, crocodiles and snakes; North Queensland is the home of the deadly taipan, whose bite means certain death. At certain times of the year one of the greatest menaces is the mosquito which can literally kill anyone stranded in the bush with no form of protection. It is a wise pilot who always carries a mosquito net in his survival kit.

To navigate in this area one needs a very strongly developed sense of direction, a lot of patience, and considerable faith in the accuracy of one's compass. The sense of direction because the terrain is utterly featureless; the patience because check points are fifty miles or more apart; and faith in the compass because, after hours of waiting for one's objective to show up, it is very easy to hypnotize oneself into believing that the aircraft is miles off track, and the temptation to change course one way or the other can be almost irresistible.

The bush pilot's navigation must, of necessity, be very accurate, because his destination is usually a solitary homestead, more often than not well concealed by timber. It is quite possible, if a few miles off track, to fly right past without seeing a trace of habitation. A pilot unable to find his objective is really in trouble. There is no alternative for him to go to, and he is probably getting short of fuel. The result is usually a forced landing with more or less disastrous results. To be a bush pilot and remain a healthy one, the first rule is: don't get lost.

The types of aircraft which may be operated successfully during the whole year must necessarily be fairly light. There are two reasons for this: firstly, because ninety-nine per cent of the airstrips are cut out of the timber and are merely graded earth. In the wet season the ground becomes soft and boggy, and will stand

A stretcher case goes aboard the Dragon at Georgetown. On the right is Mr. Joe Lee, secretary of the Georgetown hospital board.

## BUSH PILOT'S ALBUM . . .

only the lightest of aeroplanes; quite often, in fact, they cannot be used at all for two to three months of the year. The second reason is economic. The population of this area is very small, and it is impracticable to operate large and expensive aircraft on outback flying, nor is it often possible to construct airstrips capable of accommodating them. Thus the outback operator is severely limited in his choice of aircraft. Stalwarts of yesteryear, the D.H. Dragon, Dragonfly and Rapide are still giving sterling service, while in the single-engine field the newest Auster is the standard aircraft for this work. Quite often, too, even the humble Tiger Moth is called upon to do its bit.

It is generally agreed that flying conditions in far northern Australia are among the worst to be found anywhere in the world. The two great enemies of the airman are the monsoonal rains of the wet season, and density altitude in the hot weather. Pilots who have never flown under tropical conditions probably regard density altitude as an abstract subject in the commercial pilot's course. In the far north nothing could be further from the truth. Density altitude can be deadly dangerous and must always be carefully considered when deciding what load may be taken off a given airstrip during the heat of the day. Most experienced outback pilots have usually had several bad scares from this source, and in consequence they have a wholesome respect for density altitude. I must confess that I am among them.

Some readers may not be quite clear as to the effects of density altitude. Briefly, it is caused by the heat of the sun, radiated from the earth, thinning out the air immediately above it. The Department of Civil Aviation in Australia have issued a treatise on the subject, and given a series of graphs from which it may easily be calculated for a given place at a given temperature. For instance, an airstrip 500ft above sea level may have a density altitude of 7,000ft on a hot day. What this means to the pilot is that his aircraft will behave as it would at 7,000ft under normal conditions with density altitude at zero. Anyone familiar with the types of aircraft mentioned above will realize what their performance would be at 7,000ft with normal full load. On take-off this condition is aggravated by the fact that most outback airstrips have been hewn out of tall timber, so that the air from ground to tree-top level, boxed in by the thick foliage, becomes even hotter —and consequently thinner—than the air outside. The full effects of density altitude must be seen to be believed. Under very hot conditions I have seen aircraft, with only normal load, completely fail to become airborne. There are a number of cases on record of pilots, inexperienced in tropical flying, who have crashed shortly after take-off because they refused to take seriously the effects of density altitude on the performance of their aircraft.

The hazards of flying during the monsoonal rains, or "the wet" as it is called in the north, need very little discussion here. Those accustomed to flying in Britain know enough about flying in sub-minimum weather, and the time-honoured customs of following roads and railways will be no novelty to them. The disadvantage in North Queensland, however, is that there are practically no roads or railways, and that the tree-tops are usually attached to a mountain two or three thousand feet high. Lest I should have painted too grim a picture of the weather, let me hasten to add that for a few months in the winter the weather is usually fine and sunny and absolutely ideal for flying.

During my stay in Cairns it has been my privilege to be associated with the Cairns Aerial Ambulance. This wonderful service is operated by the Cairns Centre of the Queensland Ambulance Transport Brigade, and is claimed to be the only service of its kind in the world supported entirely by voluntary subscription. In operation it is fast and efficient. At the centre in Cairns is a powerful radio station, which maintains a listening watch around the clock. Most outback stations have their own small transmitters and receivers. In cases of accident or illness they call up the ambulance radio and, if the case is urgent, the aircraft will be on its way within the hour. Normally an ambulance bearer is in attendance, to render first-aid and look after the patient in flight; but, should blood transfusion or surgery be necessary, a doctor from the local base hospital will accompany the bearer, and thus the patient is assured of skilled medical attention with a minimum of delay.

*The Autocar, having landed at Mitchell River Mission to pick up a stretcher patient, attracts the attention of aboriginal children.*

Those accustomed to the amenities of civilization will find it hard to realize just what this service means to the people in the outback. For them it is literally the difference between life and death. With many days of travel over bush tracks between them and the nearest medical aid, the victim of a serious accident, or the sufferer from acute appendix, loss of blood or severe burning would have no possible chance of survival.

Another feature of outback flying that is worthy of mention is the type and diversity of landing areas which one encounters, especially during the wet. Most outback places possess only one-way strips, and more often than not—almost inevitably it seems—one finds a strong, gusty wind blowing directly across them. A pilot working in these parts has ample opportunity to polish up his cross-wind landing. Windsocks, of course, are a refinement that one seldom finds (nor indeed, after a while, even looks for) and one becomes quite adept at judging the strength and direction of the wind by the foliage of trees, wind on the water tank or dam, or the behaviour of the clothes on the homestead clothes-line. This latter method, of course, is usable only on washing-days. In cases of emergency one is also called upon to land on beaches, roads, sports grounds or the main street of the township. Some of the strips, too, have been, from lack of choice, built on ground that is far from flat. Some have a hollow in the centre and some a hill, whilst others have such a gradient that it is sometimes advisable to land down-wind and up-hill.

Taking-off from some of these places at times also presents quite a problem. Anyone who has flown a D.H. Dragonfly and has experienced its tendency to swing on take-off will sympathize with the pilot who, with an urgent medical case, is forced to try a take-off from a one-way strip in the teeth of a strong cross-wind. Often have I found myself in this unhappy position and, after roaring down the strip busily pulling throttles on and off, have staggered off the ground in almost a single-engine take-off.

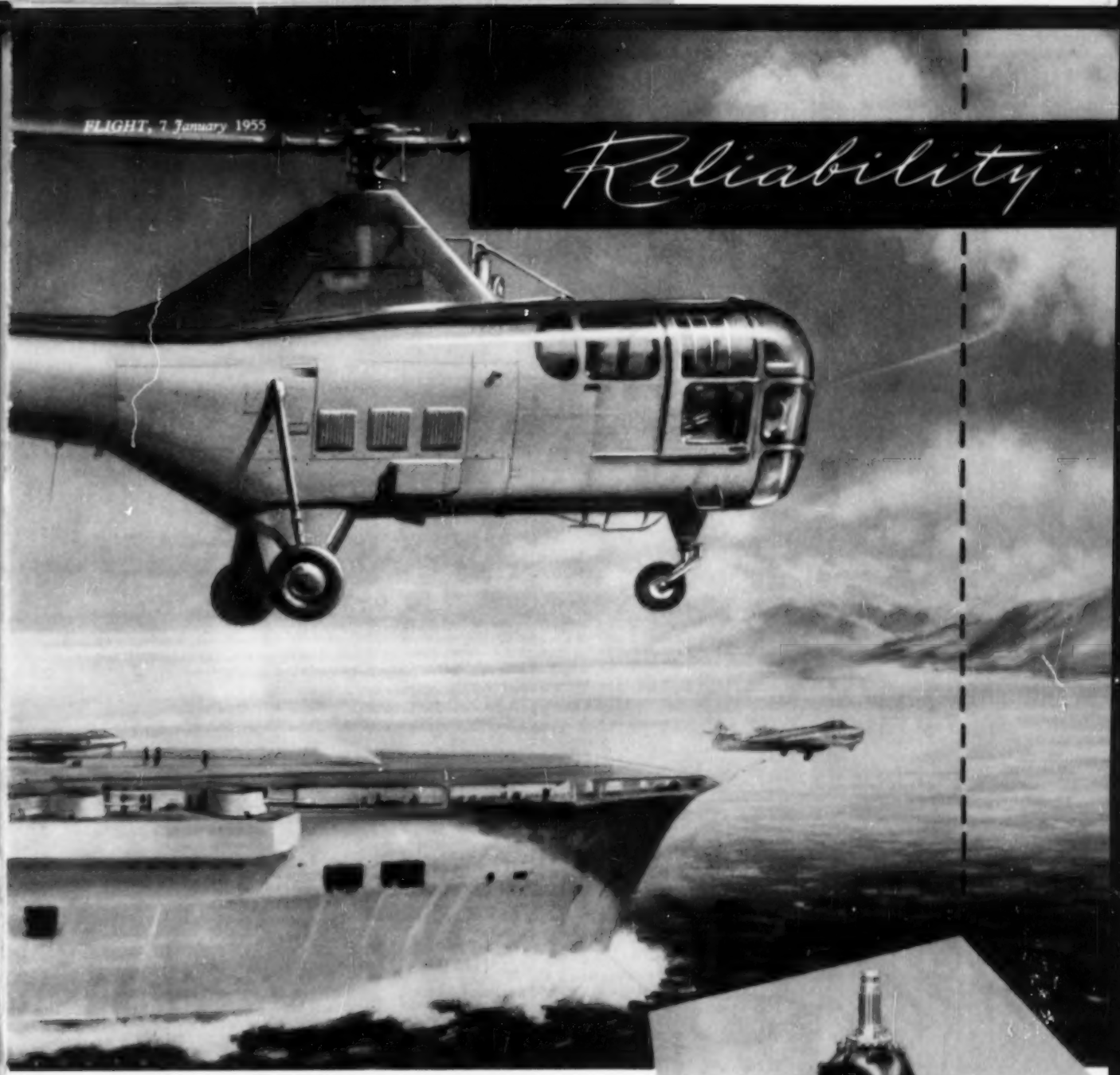
The job of the outback pilot can be quite tough and demanding in the physical sense, too. Owing to the distances covered one seldom logs less than five or six hours' flying in a day; more often than not, it is over eight. On numerous occasions I have left Cairns at first light and arrived back at sunset, having been on the job some fourteen hours and logging over ten hours in the air. On general charter and freighting work the pilot usually lends a hand with the loading, does the paper work, supervises re-fuelling, and is glad to get into the air again to get some rest.

In spite of all the disadvantages of the job, the lack of facilities, the heat, the dust and the flies, the primitive landing strips and the cross winds, the monsoons and the floods, one cannot but love this country and enjoy flying over it. There is about it a vastness, a quality of grandeur and aloofness, a stillness that captures the imagination. One can fly for mile after mile without seeing the slightest trace of man or animal. Sometimes, flying low over some remote mountain peak covered with almost impenetrable jungle, one wonders if any human foot has ever trodden this spot, and what one would find were it possible to land there. This country, the work to be done in it, and the warm-hearted friendliness and hospitality of the people, add up, at least in my opinion, to a worth-while and satisfying job.

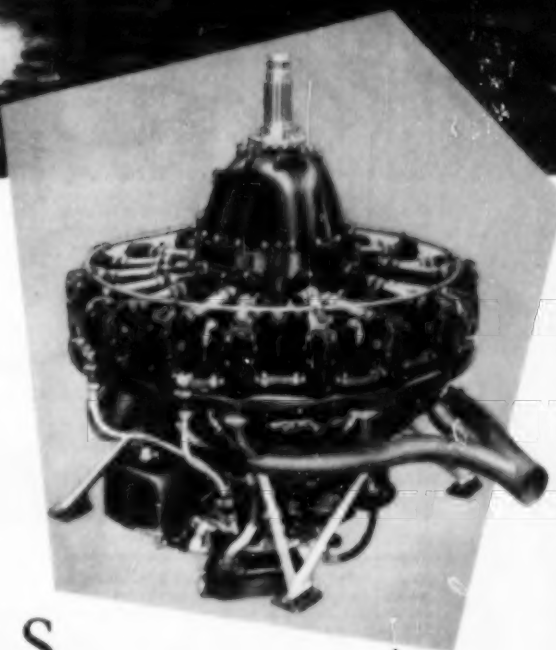
*The Dragon was presented to the Cairns Ambulance Service by Trans-Australia Airlines. Pictured at the handing-over ceremony are (left to right) Mr. E. Bradley, deputy superintendent; the author; Mr. G. Wear, Cairns manager, T.A.A.; and Capt. I. Neal.*

*Aboriginal children at the Aurukun Mission. Most ailments among the 500 natives there are attended by a resident nurse; the flying ambulance deals with the more serious cases. The Mission is run by the Presbyterian Church of Australia.*

# Reliability



Powered by the ALVIS LEONIDES Helicopter Engine, the Dragonfly serves the Royal Navy as a quick and effective means of rescue during deck landings and take-offs, besides fulfilling the routine requirements of inter-ship and ship-to-shore communications. Light and compact in design the Alvis Leonides Helicopter Engine is readily adapted to single or twin-engined installations. 520 b.h.p., 9-cylinder air-cooled radial engine. Weight complete 645 lb. Power/weight ratio 1.24 lb. per b.h.p. Overall diameter 41.5 inches.



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# HAWKER SIDDELEY PROGRESS

AT the 19th annual general meeting of the Hawker Siddeley Group which was arranged in London last Wednesday, January 5th, Sir Thomas Sopwith, the chairman, first referred to the report and accounts (which had been circulated) and then, as is his custom, described the progress and plans of the companies in the group.

He said that the trading profits of the Group for the year ended July 31st, 1954, after deducting special development expenditure and reserve for increased replacement cost of fixed assets, amounted to £6,961,041, as compared with £5,033,744 last year. Production and sales of the Group's and Dominion interests both showed an increase over last year.

After providing depreciation of £2,321,393 on the Group's fixed assets, the directors had considered it prudent to charge a further £1,000,000 for replacement of fixed assets. This reserve was thereby increased to £7,000,000, the whole of which had been provided from taxed profits.

"The present high rate of taxation," said Sir Thomas, "which for too long has been a feature of our national economy, reduces severely the profit which, after making reasonable distributions to shareholders, is available to build up industry's resources. While this prevails the increased cost of replacing capital assets is bound to remain a problem. Although the Government has to some extent recognized this problem through the introduction of investment allowances, these are inadequate and go only a small way towards the larger problem. More realistic annual allowances should be granted on industrial buildings. Many of the specialized buildings and structures essential to our industry have a much shorter life than the 50 years assumed by the annual allowance.

"Profits must also be ploughed back to enable industry to finance research and development. . . . You will note that during the year we have spent nearly a million pounds on special development projects. This is yet another example of private enterprise doing its part towards financing today's research problems to ensure production orders for the future."

Turning to the balance-sheet, the chairman said that the increase in the Ordinary share capital by £5,822,350 had been explained in the directors' report. The Board were recommending a final dividend of 7½ per cent. less tax, which was the maximum final Ordinary dividend.

Sir Thomas went on to say that since the end of the financial year the Group's Canadian interests have been reorganized into a parent company, and subsidiary interests on similar lines to the United Kingdom structure. A. V. Roe Canada, Ltd., had, over the last nine years, grown into the largest aircraft and engine manufacturing company in Canada. [The formation of the Canadian group was referred to in *Flight* of December 3rd, 1954, as were the details of the division of Avro Canada's engine and aircraft factories and the acquisition of new companies.]

"Our United Kingdom interests," continued Sir Thomas, "have been expanded since the end of the financial year by the acquisition of Kelvin Construction Co., Ltd., which is a company with a fine reputation in the design, fabrication and erection of industrial buildings. It has factories at Glasgow and at Greenford in Middlesex."

The chairman then continued:

"The shape of aircraft is rapidly changing and the patterns we shall see flying about the skies in the not-so-distant future will be very different from those we now know. To meet these changes the work of our scientists and technicians becomes ever more important. There is still a shortage of people with really high technical standards at every stage in aircraft design and construction.

"Fourteen air forces have expressed direct interest in the Hawker Hunter which is now in squadron service with the Royal Air Force. The United States has increased off-shore procurement orders and contracts have been placed by Sweden, Denmark, Holland and Belgium.

"The Avro Vulcan is well advanced in production. The capabilities of this aircraft, in speed and operating height, give it a large measure of immunity from attack.

"The Avro Company is producing the Shackleton Mark 3. A valuable order for this type has been received from the South African Air Force.

"Avro's have many interesting developments in connection with electronic computers and simulators specially designed and made by themselves, which in addition to speeding up complicated calculations enable them to carry out investigations which would otherwise be impossible.

"After eleven years the production of the world-famous Meteor came to an end. Dove-tailed into the fade-out on Meteor production, the Javelin line is being built up and early production Javelins are now flying.

"Armstrong Whitworth Aircraft have, as usual, had a busy year. Their Sea Hawk sub-contract from Hawker Aircraft was completed and arrangements were made to take over all Hawker's surplus of this aircraft, thus leaving that company entirely unfettered in their Hunter production. Armstrong Whitworth are also to assist Gloster in Javelin production in addition to work they are doing on Hunters.

"Avro Aircraft, Ltd., in Canada have substantial contracts in hand for the CF-100. A development contract has been received from the Canadian Government for a new aircraft of a very advanced design, known as the C-105. All I can say is that it is a twin-engined supersonic, long range, all-weather fighter.

"Four engines in the Armstrong Siddeley range of gas turbines—the Sapphire, Mamba, Double Mamba and Viper—are in production. These engines are used in ten British aircraft.

"Equipment of the new Brockworth engine factory, including the provision of 500 houses for key workers, is virtually complete, and production of the Sapphire there is proceeding well. Facilities have also been provided for the overhaul of Sapphire and Orenda engines.

"Production of the Sapphire continues under licence in the United States where six types of American aircraft are powered with this British-designed engine.

"Development of improved versions of the Orenda continues. A new engine which embodies many unique features and has a high titanium content is being developed. We have just completed a new research laboratory which will be of great value."

Turning to rocket and guided-missile work, Sir Thomas Sopwith said that Armstrong Whitworth Aircraft had been responsible for much pioneer work on guided weapons and had achieved a great deal. In addition to firing trials which had been taking place for some time in this country, firing trials had commenced at the Woomera Rocket Range in Australia. Overall facilities for research and development had been expanded and the organization in Australia strengthened.

Armstrong Siddeley Motors had been working on rocket motors for some time. The section dealing with this work had been considerably expanded and had been formed into a separate division.

A. V. Roe and Co., Ltd., had also entered this sphere with the formation of a Weapons Research Division. . . .

At this point Sir Thomas referred to the work of the motor car and diesel engine departments. He then went on to refer to High Duty Alloys. "Progress has been maintained," he said, "we have again improved our technique in the production of close-to-form gas turbine blades, making our ten-millionth blade in the early part of the year.

"Your interest in the aluminium industry has been broadened by the acquisition of a rolling mill in Wales.

"Canadian Steel Improvement, Ltd., has made an outstanding contribution to Canada's aircraft programme as a supplier of close-to-form compressor and turbine blades. We are expanding the company's present forging capacity by additions to buildings and equipment, and widening its scope by the construction of a new large light alloy foundry.

"This new addition to the group will be able to supply Canada's growing industry with a complete range of high quality forgings and castings. In particular the company has a great deal of experience in the technique of fabricating and employing titanium.

"Air Service Training continues to operate successfully technical training schools in India and Pakistan, and also pre-apprentice and pre-cadet schools for the Pakistan Air Force which are run on English public school lines.

"Training at Hamble continues on a reduced scale in the flying, navigation, radio and engineering schools. Seventy per cent of the students are from overseas."

Before expressing some thoughts on the current status of the country's air power and that of our allies, Sir Thomas expressed thanks and appreciation to the 65,000 executives and employees of the Hawker Siddeley Group. He then continued with a reference to the wise decision on the part of the Government to supplement orders for one or two prototypes with a much larger pre-production batch.

"It should be plain to everyone," he said, "that we are now in the age of the hydrogen bomb, a weapon of destruction so vast and so horrifying that it staggers the imagination. We hold this weapon—and so do our potential enemies. There are those who say, 'If this be true, let us abandon all hope of defence.' And these prophets of despair clamour for appeasement.

"Make no mistake about it. The one sure way to invite disaster is for this country to pursue a policy of weakness.

"And strength in airpower is not only atomic strength but the ability to deal anywhere with local wars, with local tensions whether they be in Korea, Indo-China, Malaya, the Near East, the Arctic or Western Europe.

"Only one thing is sure, if war does come, it will come with supersonic speed—and probably in an opening sneak attack. And to provide defence against that requires more than courage and faith. It needs equipment and trained manpower, and that policy requires money, time and decision."

# EAST AFRICAN AIRWAYS

## *A Thriving Young Commonwealth Airline*

IN terms of traffic, revenue or fleet strength, East African Airways cannot be classed among the world's major operators. Neither does the airline boast a long and impressive tradition, having been formed only nine years ago. Nevertheless, it is one of the most important of the Commonwealth air links, serving a total area of 680,000 square miles.

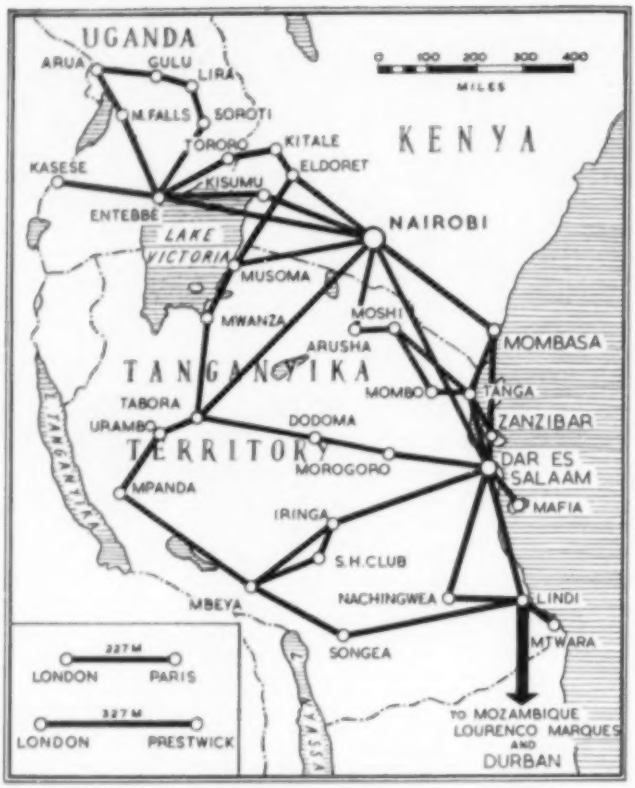
This area—more than five times that of the British Isles—represents the four territories which make up East Africa—Kenya, Tanganyika, Uganda and Zanzibar. The East African Airways Corporation was set up by the Governments concerned on January 1st, 1946, and its subsequent expansion—though little publicized at home—has been remarkably rapid.

In 1946 East African Airways carried 9,403 passengers over a 5,204-mile network of routes. For 1953, the corresponding figures were 73,062 passengers and 20,824 miles. Ton-miles performed by E.A.A. in that year totalled 2.2m, against 157,000 in 1946—an increase of 1,400 per cent.

Though low by European airlines' standards, E.A.A.'s annual passenger carryings now exceed the total white population of East Africa, which is estimated at 64,000. Most of the airline's traffic is drawn from European visitors and residents, but there is a growing proportion of potential passengers (now reckoned to be about 25 per cent) among the 205,000 Asian settlers. The 18m African population represents a virtually untapped market which will, in time, produce a greatly increased demand for air transport.

A glance at the map shows why the demand is already considerable. Great distances separate the main centres of population; furthermore, communications between areas of agriculture and mineral development are frequently obstructed by mountains, lakes, forests and deserts. Overland travel is, at best, a lengthy and tiring business, whereas air travel offers speed and comfort at reasonable cost. Most fares on the E.A.A. routes are based on a one-way rate of around 7d per mile, which is comparable with the rates charged on most regional networks outside America and Australia. Travel is encouraged by numerous concessions—to families, business and weekend travellers, sportsmen, students and school-children.

Like so many post-war airlines, East African Airways owe the greater part of their success to aircraft of pre-war design. Rapides were used initially, but traffic soon proved sufficient to justify use of larger and faster equipment—Doves and Lodestars. The 12-seat Lodestars were found to meet E.A.A.'s requirements better than the eight-seat Dove, and in 1949 the airline decided to operate a standardized fleet of Lodestars on all but the most isolated routes. By 1952, traffic had expanded to the stage where it was possible to replace the Lodestars with Dakotas.



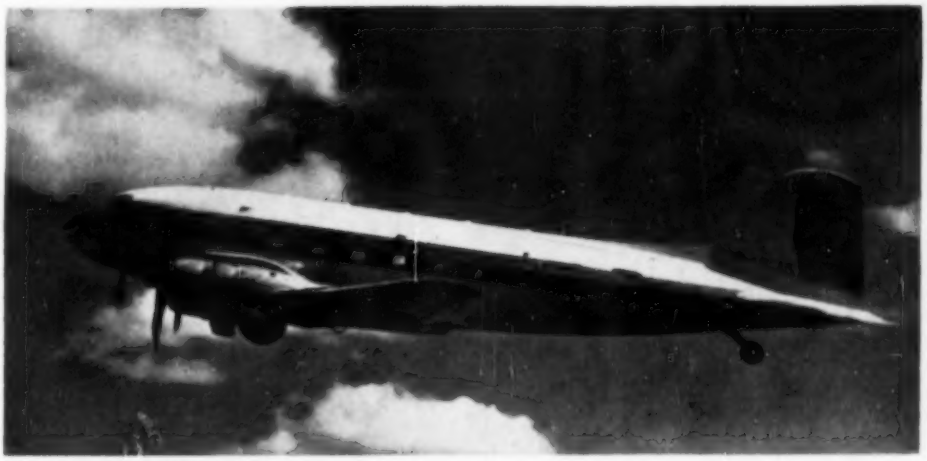

*Most of the points served by E.A.A. are shown in this map; two familiar European routes are shown (inset) to give further scale. E.A.A. also operate to Blantyre and Salisbury in Rhodesia.*

The E.A.A. fleet today consists of ten Dakotas, two Rapides and a Consul (for instrument training). Rapides are retained for local services between Nairobi and Entebbe, and for "outback" work in Uganda. All other services are operated by Dakotas, which are performing so well that the problem of choosing a replacement does not at present appear to worry E.A.A. greatly; in terms of flying life, the E.A.A. aircraft are comparatively young, and offer several years' more useful service.

Anyone interested in the subject of DC-3 replacements would profit from a journey on E.A.A.'s routes. Of the 27 East African airports served by Dakotas, the majority have short runways (or strips of grass or compacted earth) and no aids other than VHF/RT. Most are situated well above sea level, and some airfields are over 6,000ft a.m.s.l.; temperatures are usually high, so that density altitudes of up to 10,000ft are experienced. "Small-field performance" is much more than a brochure phrase to the Dakota crews and passengers who travel round the E.A.A.

*Nairobi has two airports—the international terminal at Eastleigh, and the E.A.A. and charter airport of Nairobi West, where a Dakota is seen (left) taking aboard passengers for Dar-es-Salaam. Eventually both long- and short-haul services will be centred on Nairobi's new airport at Embakasi. On the right is a scene from Mbeya, 5,600ft above sea level in the southern highlands of Tanganyika; Mrs. Montgomery, E.A.A.'s sole representative there, is checking a typical load of mixed freight.*

"Flight" photographs



*(Right) One of East African Airways' ten Dakotas. H.M. the Queen has twice flown with E.A.A.—once on the day of her accession to the Throne and again during her visit to East Africa last April. Typical of the two-man crews who fly all E.A.A.'s services are (below) Capt. R. Cartwright (left) and 1st/Off. G. Hick.*

"Flight" photograph

route network at a frequency of more than 30 services daily.

Despite their heavy commitments, E.A.A. are a comparatively small organization. The staff, some 900 strong, includes 24 captains and 19 first officers. All checks and overhauls, other than Dakota engine overhauls (which B.O.A.C. perform on behalf of E.A.A.) are undertaken in four hangars at Nairobi West Airport by an engineering staff of 120, of whom 74 are Europeans. Many visitors from Britain have been impressed not only by the keenness and efficiency of East African Airways' employees, but also by the awareness at all levels of the relationship between individual effort and overall purpose.

The standard seating plan for E.A.A.'s Dakotas is for 28 passengers but the aircraft sometimes operate as mixed passenger-freighters carrying 16 or 22 passengers forward and a load of cargo stowed in wire-mesh cages towards the tail. A few months ago the company introduced the first scheduled all-freight service in Africa, operated weekly between Nairobi and Dar-es-Salaam. Three of the fleet have been fitted with special lashing points in the fuselage so that they can be quickly converted for this service. East African Airways are extremely freight-conscious, as witness the fact that between 1952 and 1953 the annual cargo uplift increased from 820 tons to 1,400 tons—the equivalent of 500 Dakota-loads. The biggest single commodity carried in 1953 was milk, of which well over 200 tons were transported from Mombasa to Dar-es-Salaam; the airline also flew the empty cans back to Mombasa—probably one of the least valuable payloads ever carried commercially by air. Until this lift began fresh milk was unobtainable in Dar-es-Salaam.

Many of the company's flights through the more remote outposts of East Africa are classed as social services. On the basis, however, that E.A.A.'s activities are "as a whole of common interest" to all East African territories, no attempt has been made to separate economic from uneconomic routes. During 1953 the airline expected to lose between £40,000 to £70,000 and it was agreed that this loss should be met by the three main territories in the following proportions: Kenya and Tanganyika, three-eighths each; Uganda, two-eighths.

In the event, East African Airways succeeded in making a profit of over £3,000, which was used to offset the previous year's £7,000 deficit. Due to rising costs and other factors, including the Kenya emergency, the Corporation forecasts a loss of £62,000 for 1954, but the year's results are not yet known.

Broadly speaking, the most important routes from the viewpoints of both traffic and revenue are the trunk services linking Nairobi with the big ports on the east coast of Africa and the international services to Blantyre, Salisbury, Mozambique, Lourenco Marques and Durban in the south. Profits are also made on the airline's charter services, but losses are incurred on the less heavily patronized services to the smaller inland centres.

It is now an open secret that East African Airways hope to supplement their present fleet with Argonauts as soon as these excellent Canadair transports begin to retire from trunk-line service with B.O.A.C. Their acquisition would enable E.A.A. to offer faster and more comfortable services from their base at Nairobi to the Tanganyika coast and to Salisbury and Durban in the south. It is also believed that the airline would also like to open an Argonaut service to London.

Chairman of the Board of East African Airways Corporation is Sir Alfred Vincent, a member of the East African Central Legislative Assembly. Capt. Malin Sorsbie, O.B.E., has been general manager since 1948. The development of air transport in Africa owes much to Capt. Sorsbie, who is a former pilot with 8,000 hr to his credit.

R. B.

# WING DROP and PITCH-UP

## *Some Phenomena of High-speed Flight Discussed in S.A.E. Lecture*

ONE of the papers read at the Los Angeles meeting of the American Society of Automotive Engineers was by Earle S. Hodder, aerodynamics supervisor, North American Aviation, Inc., who dealt with some of the problems of high-speed flight. Mr. Hodder made it clear that his paper was a review of some of the more important problems which had arisen in this field since World War 2, and which could be dealt with without infringing security regulations. His opinions were not necessarily those of his company.

**Flow Characteristics.** The speaker devoted the first part of his lecture to a review of the changes in airflow about an aerofoil as a function of Mach number. He showed a number of diagrams illustrating typical flow configurations over an aerofoil; these, he said, were substantially the same for any aerofoil, although those with sharp leading edges and small thickness were less seriously affected.

Compression shock-waves occurred when the flow over a portion of the aerofoil reached sonic speed, and formed at the point where the flow once more became subsonic. The acceleration occurred smoothly. Waves normally formed on the upper surface before they did so on the lower surface, and as the speed of the flow increased above Mach 1.0, the wave was progressively inclined rearwards. A bow wave ahead of a wing formed in a similar way. Another important characteristic was the separation of smooth flow from the wing skin close to the base of a shock-wave. Over a thick wing, the separation was considerable, but it was much less on an extremely thin wing. This area of separation fluctuated over the wing surface and caused a stalled condition which was responsible for such effects as buffet, and control surface buzz or tap.

Mr. Hodder quoted some measurements taken of the wide wing-wake resulting from shock-waves and flow separation at the transonic drag-rise for the F-86D. At a $C_L$ of 0.25 (equivalent to 1g at 40,000ft) an increase of Mach number from 0.9 to 0.95 increased the wake thickness by only 30 per cent, while at a $C_L$ of 0.55 (2.3g) the wake thickness increased about 100 per cent with the same Mach number increase. Further disturbances which gave some measure of the energy lost in the wake might, for the two above cases, show even greater increases with rising speed.

**Wing Drop.** Having thus stated the basic situation, Mr. Hodder went on to deal with wing drop which, occurring near the drag rise, was a result of the compressibility effects just described. Normally shocks occurred on each wing as an aircraft entered the transonic range and were accompanied by flow separation. Inequalities in the wings, originating in manufacture or subsequent wear, would cause the resultant loss of lift to occur on one wing before the other, with a consequent wing drop or "roll off." Opposite aileron tended to aggravate this, since the down aileron increased shock intensity with further loss in lift. An aileron might in any case be operating in the separated-flow region and therefore have a greatly reduced effectiveness.

Aileron deflection further aggravated wing drop by twisting the wing, particularly at low altitude, or on a wing of a low stiffness. The speaker quoted the case of the F-86D, where the aero-elastic effects of aileron deflection made it impossible to raise the wing by aileron at high speed below 5,000ft. Individual aircraft varied, of course, some dropping the left and some the right wing, and some having no wing drop at all. Decreasing the F-86D's T/C ratio from an effective 9.2 per cent to 6 or 7, the speaker thought, would undoubtedly minimize wing drop and even eliminate it. To achieve similar results with a straight wing would require a maximum T/C ratio as low as 5 per cent.

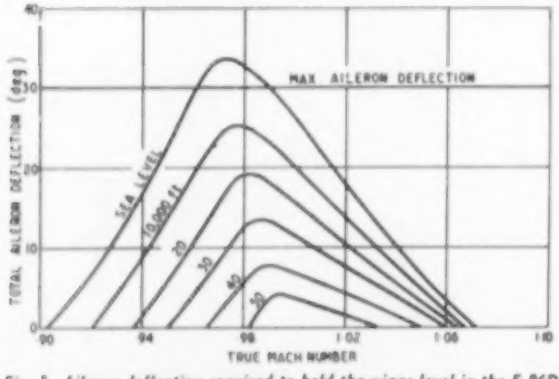



*Fig. 1. Aileron deflection required to hold the wings level in the F-86D at various altitudes. The sea-level line can be seen to exceed the "maximum available deflection" line.*

Such low ratios might free the supersonic fighter from wing drop troubles; but in bombers and transports, though the ratios might be the same, the trouble might still occur if the wing structure were designed to lower stiffness and strength factors. This would particularly aggravate aileron deflection characteristics.

Yet another factor affecting wing drop in the supersonic aircraft was thought to originate from the bow wave from the nose of the aircraft, a wave which was substantially the same as its counterpart on the wing. As Mach number increased, the bow wave inclined ever more sharply rearwards, and any asymmetry in it caused by slight yaw or structural inexactitudes might cause it to affect one wing before the other. Asymmetric shock waves from other parts of the structure forward of the wing might also give rise to wing drop.

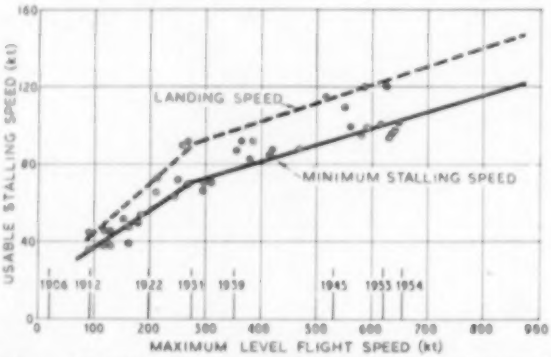


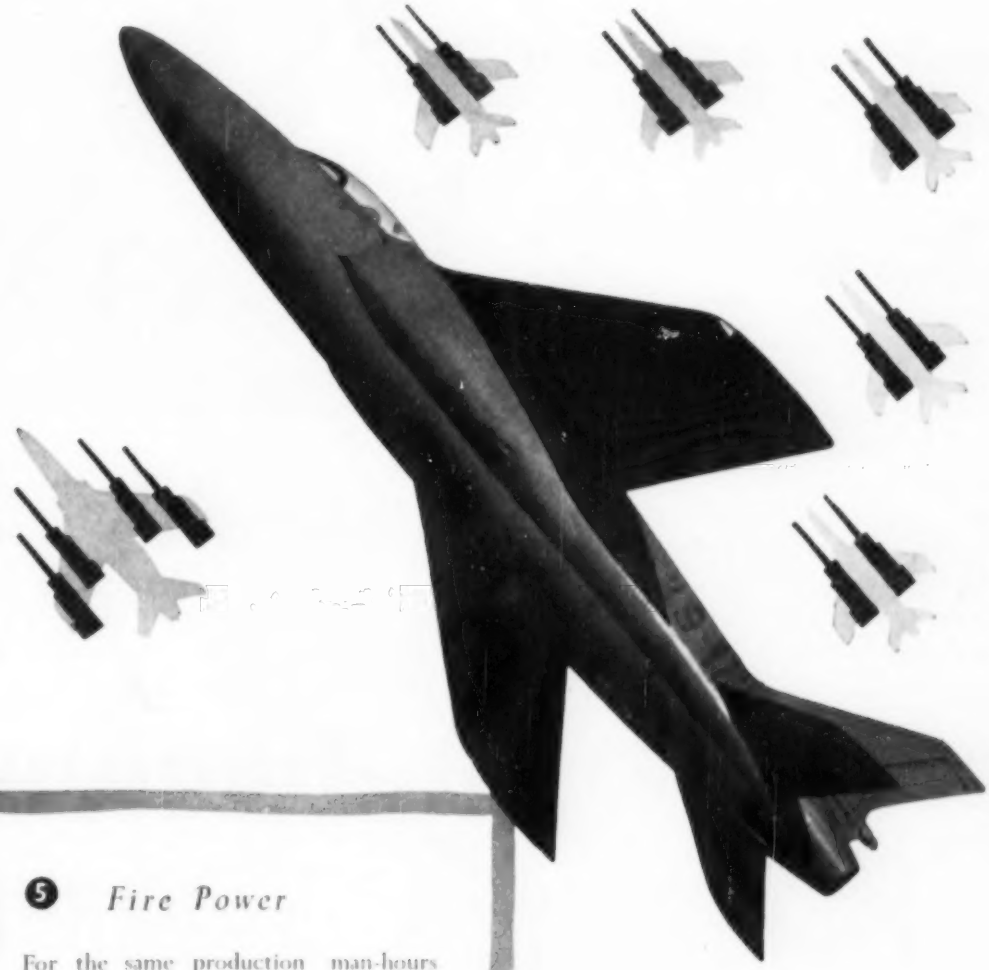

*Fig. 2. Comparison of maximum level flight speeds and stalling speeds for a wide variety of American aircraft since 1906. The stalling speeds are those for the landing configuration.*

**Pitch-up, Dig-in or Overshoot.** This effect, the speaker said, was first encountered in World War 2 fighters and had occurred again from time to time. It consisted of a sudden tightening of a turn or pull-up to a g-loading considerably higher than the pilot had intended to apply. There were several causes, and one of the earliest had been the elevator trim-tab. The pilot would begin a dive and would progressively trim-out stick forces with the elevator tab. Eventually, however, shock-waves and flow separation on the tailplane would drastically reduce, if not cancel out, the effectiveness of the tab. Because of high stick-forces, the pilot would then use the trimmer during the pull-out, although it was ineffective; but, as the load factor increased, the aircraft slowed down until, as the shock-waves dissipated, the trim tab would regain its full effectiveness and cause a rapid pitch-up which the pilot would not be able to control. The speaker stated, however, that this was not likely to occur nowadays, since no one in his right mind would now use a conventional elevator-tab system on a supersonic aircraft.

Another cause of pitch-up was the large increase in static stability margin with rising speed. If a pilot flying at Mach 1.2 and a $C_L = 0.1$, pulled up to 5g ($C_L = 0.5$), the increased drag would decelerate the aircraft to perhaps Mach 1.0. While with increasing speed, the c.p. would move back over the wing, as the speed decreased again it would once more move forward; and if the tailplane angle were maintained as for the original g application, its effectiveness would increase with decreasing speed. The result would be a nose-up pitch. This characteristic was already experienced in transonic aircraft and would doubtless continue to occur in supersonic aircraft. It was aggravated by the relatively low effectiveness of the elevator at transonic speed. The effects could, however, be overcome to some extent by very powerful tailplane controls; in any case, the movements of centre of pressure would not be great above Mach 1.5.

Another source of pitch-up was found between Mach 0.6 and 0.9 at a $C_L$ between 0.4 and 0.6 Pitch-up might then occur

# *Where the* GNAT LIGHT FIGHTER *scores*



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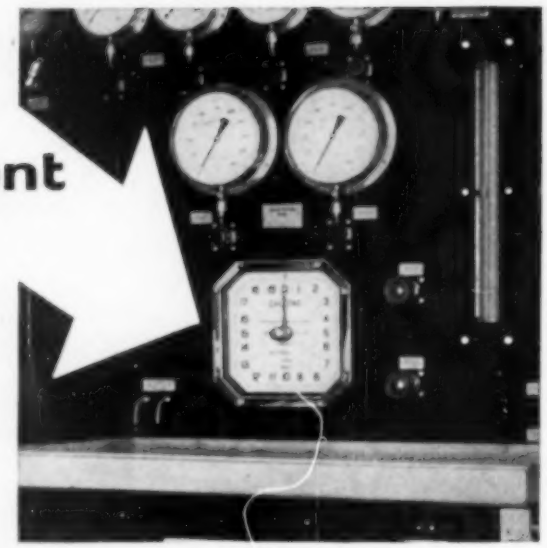

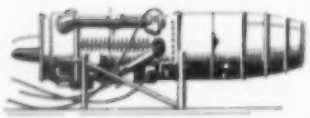

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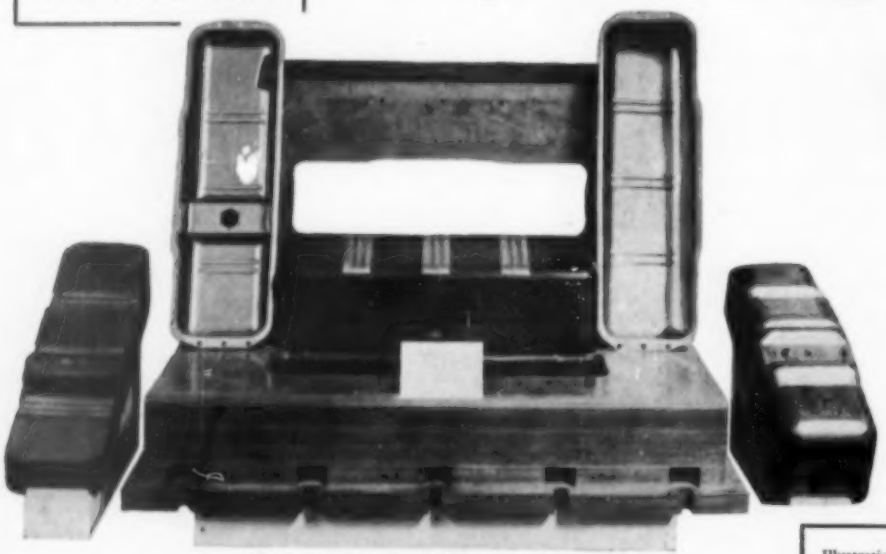

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Illustration shows "Hy-du-lignum" Press Tool, used on DH 600 Clearing, Treble Action Press for 20 gauge mild steel Petrol Tank Body Pressings. Interchangeable Punches and Ejectors with common die and pressure plates to produce top and bottom body halves, 3ft. long × 10 in. wide × 8 in. deep. Photograph by courtesy of Morris Motors (Radiators) Limited.

## WING DROP AND PITCH-UP . . .

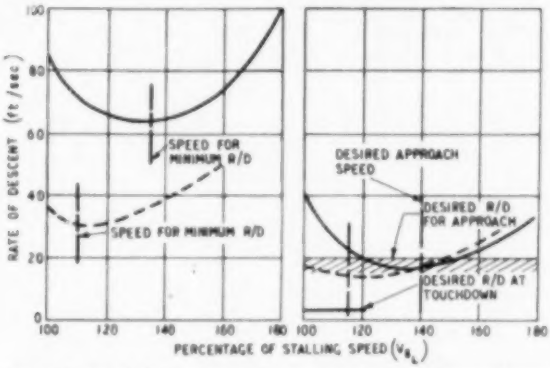


*Fig. 3. Rates of descent at idling power (left) and approach power (right) for hypothetical transonic (dotted line) and supersonic aircraft, plotted against speed shown as a percentage of the stalling speed in the landing configuration ($V_{SL}$).*

even at constant Mach number, but it could be minimized and even eliminated by proper selection of wing plan-form, wing leading-edge camber, slats set to open at these values of $C_L$, and sometimes by proper location of the tailplane in relation to the wing. Tailplanes set below the wing were so placed in recent supersonic aircraft primarily for this reason.

**Unaccelerated Stability.** Unaccelerated stability implied high positive stability at a constant Mach number, and positive unaccelerated static stability would be described by a pilot as a condition where increasing forward stick-movement would be required if the speed were increased. If cruising in the Mach number range where this phenomenon occurred, the pilot might, for example, trim the aircraft "hands off" for Mach 0.95. If a gust was then encountered which slowed the aircraft to Mach 0.93 (I.A.S. change of 7 kt at 40,000ft), the trimmed tailplane position would, with the pilot's hands off the stick, remain constant and cause the aircraft to start a slow pull-up to 1.2g. This increased g would further slow the aircraft up and lead to yet further g. The aircraft would always wander away from its trimmed cruising speed and accurate cruising would require continual attention.

The severity of this characteristic depended mainly on the wing plan-form and the aerofoil section used, and to some extent also on the tailplane location. From the pilot's point of view, unaccelerated stability effects could be explained as follows. The speaker assumed the pilot intended to pull 3g at Mach 1.0, and set from −1.25 to −3 deg on the tailplane. If he could maintain his Mach number by power or dive, no pitch-up would occur but, if the Mach number decreased to about 0.95 with a constant tailplane angle, he would experience 4g instead of the 3g applicable at constant Mach number. This would not be serious unless a structural limitation became involved, for example, in aircraft with low limiting load factors. This type of pitch-up, the speaker said, could probably not be entirely eliminated and very effective tailplane controls, preferably of the "all-flying" or "slab" type, would be required, as opposed to the erstwhile conventional tailplane and elevator.

**Landing Speeds.** For pilots, one of the major drawbacks of high-speed aircraft was their high landing speed. Yet the demand for higher speeds inevitably increased stalling speeds, as the graph (Fig. 2) showed. Stalling speeds for many different types of aircraft, from the Mooney Mite to the F-86, were plotted.

The speaker added that high landing speeds lead to high costs, particularly in tyre and brake wear, since modern braking systems provided little feel for the pilot at ground speeds of 100 to 110 kt; this low available braking power, combined with lift on the wings —which lessened the weight on the wheels—caused many pilots to burst tyres before they became accustomed to the conditions. Furthermore, the cleanness of modern aircraft almost eliminated the aerodynamic drag which was a traditional source of landing-run deceleration. Also to blame were increased airfield sizes and greatly increased take-off weights. Amongst various remedies, the speaker cited the tail parachute which, he said, worked very well; turbojet reverse thrust would also prove useful. Flaps, on the other hand, were no longer sufficient to prevent the increase of landing speeds as maximum level speeds grew higher.

Boundary-layer control by blowing and/or sucking was supposed to be the cure-all for the future, and appeared to be yielding something after years of research, although it might only be a 10 per cent decrease in stalling speeds. Pilots would, however, have to be instructed in realizing this improvement, since so many of them, especially in the Air Force, worked on the age-old principle of increasing the touch-down speed by 5 kt each for wife and children. The speaker remarked that, in his experience, most pilots appeared to have at least five children, and suggested that more training was required in low-speed flying. Training and indoctrination would, he thought, be the joint responsibility of the Air Force and the manufacturers, and if not carried out would lead to a high landing accident rate in the future.

**Approach and Landing Rates of Descent.** The speaker said that current wing designs militated against good landing characteristics because the wing loading was generally from 40 to 60 lb/sq ft in the landing condition, and aspect ratios about 6 for a transonic aircraft and 3 for a supersonic aircraft. Both these factors combined to make landings at idling power or with power off extremely difficult. Observation of operational flying had shown that pilots liked to approach with approximately the same rate of descent regardless of the type of aircraft being flown. Acceptable rates of descent were usually between 8 and 25ft/sec, with an optimum of 17ft/sec. Preferred touch-down rate of sink was 2 to 3ft/sec. Most aircraft hitherto had employed an approach speed of 140 per cent of the stalling speed in the landing configuration ($V_{SL}$). Touch-down speed was 110 to 120 per cent of the $V_{SL}$, and it was desirable in consequence that the speed of minimum rate of sink should occur near the touch-down speed to ensure good round-out characteristics.

The graph (Fig. 3, left) showed approach rates of descent in excess of the acceptable limits, and a supersonic aircraft sank even faster than a transonic aircraft. The transonic aircraft's minimum rate of sink occurred at 1.2 $V_{SL}$, while this was 1.35 for supersonic aircraft. In both cases, a powered approach would be required to obtain the desired rate of sink. The effect of a powered approach, however, was to raise the speed for minimum rate of sink to a higher value. In the cases shown, the effect was small but the trend was undesirable.

The graph showed that the rate of descent increased at speeds less than 1.4 $V_{SL}$. Thus, if power was held constant during the approach, the rate of sink would increase as the speed decreased during the round-out. The implication was obvious—namely, that as soon as the pilot attempted to round-out, his rate of sink would increase instead of decreasing. He would therefore have to approach at something over 1.4 $V_{SL}$ in order to be able to exchange kinetic energy for g to reduce his rate of sink by rounding-out. This would require an approach speed of 1.5 to 1.6 $V_{SL}$. He would also have to judge his round-out point very accurately and touch-down before the rate of sink reached an unacceptable level. He would therefore not be able to spend long at doing "a little stick-jockeying to feel for the ground." In any case, this characteristic would imply a touch-down speed for a supersonic aircraft in excess of the normal 1.2 $V_{SL}$.

The speaker enumerated five devices which would assist in obtaining a lower speed of minimum rate of sink as follows: (1) wing flaps, (2) drag-producing features such as speed brakes and drag parachutes, (3) high aspect-ratio, though this was undesirable on the score of weight and aero-elastic effects, (4) low wing-loading, very desirable but difficult to obtain, and (5) wing boundary-layer control.

**B-45 Engine Test-bed Experience.** Mr. Hodder next mentioned some jet-efflux characteristics experienced while testing large jet engines suspended under the bomb-bay of B-45s. Severe tail-buffeting had occurred while running the test engine with afterburner lit. This, he said, indicated a new problem in supersonic aircraft.

During initial trials, no trouble had been experienced, but when the afterburner was first lit, the resulting tail buffeting was so severe that the test was discontinued, and subsequent inspection showed cracks in the tailplane ribs. These could not have been caused by the efflux directly striking the tail, since the two were separated vertically by 11.25ft. There could be only two other causes, firstly, that shock-waves originating at the tailpipe struck the tail, and secondly, that high-energy pressure waves combined with the normal pressure pattern over the tail to cause unstable shock-waves in that region, together with flow separation. The tests were being conducted at Mach numbers where mild normal shock-waves were in any case occurring over the tail. Similar problems might arise in any supersonic aircraft where portions of the aircraft extended beyond the tailpipe efflux. Mr. Hodder suggested that some research organization such as N.A.C.A. should investigate this problem with a high-altitude test flight programme.

**Conclusions.** The speaker said that many of the problems associated with supersonic flight would probably be solved within the next ten years. He suggested, however, that the greatest improvements should be sought in reducing landing speeds for the pilot's sake. V.T.O. and flying-saucer configurations might, he thought, provide some answer, and in this connection he suggested the quotation "although it may not be good aerodynamic design, you can fly anything, even the kitchen stove, if you put enough power on it." The speaker predicted that though his audience might not find this quotation humorous at the moment, they undoubtedly would do so if they read his paper in a hundred years' time.

# CORRESPONDENCE

*The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.*

### Gnats, Venoms for R.Aux.A.F.?

THE recent announcement about the future of the Royal Auxiliary Air Force squadrons must have given rise to great dismay among the personnel of these vital air defence units.

Surely, if the Hunter and Swift are too complex for "week-end" flyers to master (a fact which these pilots appear to deny) why can they not be provided with other aircraft? It would seem that here is a case for the cheaply and speedily built high-performance and easy-to-handle Gnat light fighter, which could provide a highly efficient fighter reserve at low cost.

If the Government are determined not to order the Gnat, there is another alternative. Most, if not all, Auxiliary pilots have handled the Vampire. They would not find it very hard to master the Venom. This effective fighter-bomber has earned the praise of the pilots of the Second Tactical Air Force, for its high rate of climb, power of manœuvre at all levels, heavy offensive load, and useful turn of speed. If it is good enough to form the new day fighter equipment for all squadrons in the Middle East and the Far East, it is surely a useful weapon for supporting the regular squadrons in bomber interception at home, with an alternative rôle as a ground attack fighter on the European mainland should the need arise.

Pantgwyn, Cardigan. PETER M. THOMAS.

### Third-hand Constellations

IT certainly was gratifying to observe that my short article "Under Three Flags" [October 1st] evoked interest amongst several of your regular readers. Having just received my copies of *Flight* dated October 15th and October 22nd I was interested to read the letters from Messrs. Hunter, Taylor and McGee.

With regard to Mr. Hunter's statement that the amount paid to the insurance underwriters was $244,000 and not $100,000 as stated, to the best of my knowledge neither B.O.A.C. nor the British Aviation Insurance Co., Ltd., had previously disclosed the actual figure: in these circumstances the figure of $100,000 was given because it had been quoted to me by what I considered to be a fairly reliable source. This small point once again suggests that when that abused word "security" is not involved the best policy is "full information." Incidentally, Mr. Hunter and others may be interested to learn that back in 1945 at least four surplus C-69 U.S.A.F. Constellations were sold by the U.S. War Assets Administration for as little as $20,000 each, whilst two others were sold for a mere $40,000 each.

Mr. Taylor will no doubt be interested to learn that yet another Constellation will shortly be "Under Three Flags." This is ex-K.L.M.'s PH-TDB *Batavia*, which was sold to Capital Airlines in September 1953 and made her "delivery flight" to New York on October 8th, 1954, *via* Prestwick, then bearing her owners' colours but still registered PH-TDB. In the near future she will be transferred to B.O.A.C. under the recent "exchange deal plus cash" announced by both the airlines concerned. And I'll hazard a wager that 4X-AKD will be "Under Four Flags" sometime in late 1955 or early 1956.

Nairobi, Kenya. DENNIS M. POWELL.

### U.S.A.F. "Special-delivery Outfits"

I HAVE just read with considerable interest your article [December 24th] on the F-84F in its connection with the special-weapons capability of the 49th Air Division. Either the 81st has a wonderful P.R.O., or else you were given erroneous information which I beg to correct.

The 81st has been in England several years longer than the 20th Fighter Bomber Wing, of which I am honoured to be a member. Until fairly recently, when the 81st joined the 49th, it (the 81st) was a distinctly ordinary fighter group, flying F-86s. The 20th, on the other hand, has been writing the book on tactical atomic weapons since many months before our arrival in England in May 1952, after flying our "Crowbars," as we call the 84G, across the Atlantic *via* Greenland and Iceland. The 20th has been in the atom business longer than any other unit in the world, unless I am sadly mistaken.

Our wing commander, Col. Dunning, has twice flown F-84s over the North Atlantic. Our deputy for operations, Col. W. D. Ritchie, was one of the first two pilots to complete a non-stop east-west crossing of the Atlantic. Col. Holt checked out in the 77th's F-84Gs some months before his assignment to the 81st.

After all the work we in the 20th have done, in the years when we and the 47th Bomb were the only special-delivery outfits in Europe, it is rather discouraging to see excessive credit given to the new boys of the 81st. After all, *we* taught them, not *vice versa*.

There are many points of comparison which I shall leave out of sympathy for the feelings of the 81st. It must be bad enough to be praised by mistake...

Wethersfield, Essex. FRANK G. BELL,
1st Lt., U.S.A.F., 77th Fighter Bomber Sqn.

# THE INDUSTRY

## Controlling Rolls-Royce Quality

WHEN Mr. E. J. Cantrill, M.I.Mech.E., F.R.Ae.S., retired last week from the post of chief quality engineer in the Rolls-Royce aero division he was succeeded by Mr. F. Nixon, B.Sc., M.I.Mech.E., F.R.Ae.S. After early experience in I.C. engine manufacture, Mr. Nixon joined the Royal Aircraft Establishment and, later, the engine department of the Bristol Aeroplane Co. Here he was design manager under Sir Roy Fedden when he left to join Rolls-Royce in 1942. With the latter company he has been successively deputy to the chief powerplant engineer and chief powerplant quality engineer in the flight establishment at Hucknall, and chief sales and service engineer and assistant general manager in charge of new manufacturing processes at Derby. Mr. Nixon has travelled extensively in order to study engine design and manufacturing practice. During the war, for M.A.P., he performed quality-control of all heat-exchange equipment used in the R.A.F., and also headed a technical mission to the U.S.A.

*Mr. Nixon.*

## Facing Facts

A REALISTIC view of the industrial outlook was taken by the chairman of the Plessey Co., Ltd., Mr. A. G. Clark, in his statement issued in advance of the annual general meeting, held on December 30th.

"I am not an economist," he said, "and I speak as an engineer, but a disturbing feature of the general industrial situation is that the costs of production continue to rise. The rise may be small each year, but the effect is cumulative, and as compared with the costs of five years ago the increase is significant. To the best of our ability we cope with this problem by improvements in methods and in machinery but the plain fact is that, in spite of all that is being done to use the best of plant and the best of methods, the final cost of producing the apparatus or equipment with which we are concerned has increased and is increasing.

"For this reason I am not able to look at future prospects without anxiety. It is possible to price oneself out of world markets, and inflationary tendencies involve the risk that slowly but surely we may reduce the market which is open to our products. And, as that market is reduced, it becomes correspondingly the more difficult to carry the heavy and inevitable research and development charges which must be faced if the technical supremacy of our production is to be maintained. There is little room for complacency here, and I can assure you that we have few illusions in respect to the struggle which lies ahead of us."

In reviewing the year's activities Mr. Clark had said that the increased volume of work had brought an increase in profits, and at £1,125,710 the total profit before taxation was some £180,000 higher than in the preceding year; as was now usual, taxation absorbed the larger share of this profit—£652,000 had been taken, leaving £473,000 available for dividends and for ploughing back into the business.

## Hawker Siddeley Apprentices Rewarded

STEADY expansion of the Avro apprentice-training scheme was emphasized at the annual prize-day, held shortly before Christmas, when Sir Roy Dobson (managing director) inspected the apprentices' work and presented certificates and prizes. Only a year ago a target figure was set of 650 trainees in two years'

*An Avon engine undergoing reheat testing is the subject of this painting by Terence Cuneo. Commissioned by Shell-Mex and B.P., Ltd., it was recently presented to Lord Hives (left), Rolls-Royce chairman; on the right is Mr. C. M. Vignoles, Shell-Mex managing director.*

*At the Handley Page apprentices' prize-giving, referred to below: J. Davies receives a managing director's prize from Mr. L. J. Dunnett of the Ministry of Supply. In the background are Mr. H. Deacon, apprentice supervisor, and Mr. R. W. Walls, principal, Hendon Technical College.*

time; already this has been exceeded, for there are now 669 boys under training. There is keen competition for the 130 vacancies. Of these, 30 engineering apprentices and 70 trade apprentices are required at the Chadderton factory; at Woodford Aerodrome, 30 trade apprentices are required; and there are also about ten apprenticeships each year for boys intending to go to universities and a similar number for university graduates, as part of the technicians-under-training scheme.

The Kelly prize for the best workmanship by a first-year apprentice went to J. T. Harris and the award for the best all-round apprentice to R. A. Gellatly. In addition, three progress prizes were awarded, 12 apprentice-of-the-year prizes, and ten awards for attaining the H.N.C. or its equivalent.

Another company of the Hawker Siddeley Group—Hawker Aircraft, Ltd.—also held its apprentice prize-giving shortly before Christmas. Mr. A. N. Spriggs (managing director) presided. The apprentice of the year was P. Hickman, and prizes were received by ten others. On the same occasion, at the other end of the service scale, clocks were presented to 41 employees with more than 25 years of service each.

## Handley Page Occasions

SPEAKING at his company's recent apprentice prize-giving, Sir Frederick Handley Page said that so valuable had been the results obtained from the firm's apprenticeship system that it had been decided to increase the annual intake and raise the total number of apprentices to some 300. The works school was being enlarged to accommodate these numbers; new machine tools had been ordered and it was hoped to complete the extension shortly.

The prizes were presented by Mr. L. J. Dunnett, Deputy Secretary, Ministry of Supply, who congratulated the apprentices and the advisory committee on an oustandingly successful year.

Among the prize-winners was D. Lennard, who gained first-class honours in engineering in the London B.Sc. examinations—the first occasion on which this has been achieved by one of the company's engineering apprentices studying under a part time course. R. Ayres, who also gained his B.Sc. degree, is the winner of a S.B.A.C. scholarship in competition with apprentices from the entire industry; he is now at the College of Aeronautics.

Another recent Handley Page function was the annual Christmas dinner of the senior staff, at the Café Royal, London, on December 22nd, and here one regret was expressed—by Sir Frederick Handley Page himself. Having listened to compliments bestowed on his company's products by the Mayor of Harrow—the guest of honour—he was "sorry that there was no vacancy in the sales or publicity departments." The content of the evening's speeches was largely domestic and full of the good humour which always pervades these admirable H.P. functions.

*The Black and Decker crash-rescue power saw in use during the London Airport demonstration described on page 950 of "Flight" last week. Trying it is Mr. J. D. Profumo, Parliamentary Secretary (Air) to the M.T.C.A. The Ministry have now announced that they intend to provide power saws for the fire services at all their more important airfields.*

# IN BRIEF

A new factory opened at Annfield Plain, Co. Durham, last year by Ransome and Marles, Ltd., of Newark, is already being overtaxed by the heavy volume of production of ball and roller bearings. The company has accordingly signed an agreement with North Eastern Trading Estates, Ltd., for an immediate extension to be made to the plant.

* * *

One of Lodge Plugs' golden jubilee year celebrations took place in Rugby recently, when 55 employees received watches and certificates in recognition of their service. The presentations were made by Mr. V. Martin-Jones, managing director, and Mr. Derek W. Pritchard, director. The total service of those who received awards was 1,649 years.

*Mr. R. J. Raft, A.C.A., A.C.W.A., newly appointed secretary of Rotol, Ltd., and British Messier, Ltd. He joined the two companies as chief accountant last May; previously he was director of costing at Tube Investments, Ltd.*

Following the death of Mr. Frank Gannon (see *Flight*, August 20th, 1954) it has been announced that his company, British Aircraft and Engineering Pty., Ltd., would cease operations on December 31st, 1954. Mr. Gannon was representative in Australasia for Blackburn and General Aircraft, Ltd., and the company state that, until new agents are appointed, they will handle Australasian business from their London office at 43 Berkeley Square, W.1.

*The Industry*

# EXPANDING ELECTRONICS

PARTICULARLY in modern and specialized fields of technology it is still possible for a small group to start a thriving privately owned company from scratch. Winston Electronics, Ltd., owes its existence largely to Mr. F. W. Reynolds, formerly technical sales manager (London and Southern England) for Standard Telephones and Cables, Ltd. He started the company in 1950, in a mews on Hampton Hill, Middlesex.

Following a policy of original design and of aiming at being "first in the world" wherever possible, the company has grown until present employment approaches one hundred. Winston Electronics have spread along the mews in which they started and into the adjoining houses and shops. Their organization, however, will shortly be made considerably easier when they move into a completely new factory at Shepperton, the foundation stone of which was laid by Mr. John Profumo, Parliamentary Secretary (Aviation) to the M.T.C.A., on December 20th.

The factory, the floor and skeleton of which are already complete, is the first demonstration of the Cranleigh system of "tailormade" pre-fabricated permanent factory building. F. and D. Hewitt, Ltd., are erecting the shell, complete for occupation, at what is claimed to be one-third the cost and in one-third the time of that required by other methods of building a facility of the same area. By this method, factory frames may be of any span (to the nearest inch) and not of fixed size or modules (i.e., grid dimensions for dividing plans or elevations into proportional units).

Winstons' technical staff is arranged in four complete development teams. In addition to the equipment described below, their products include an electronic lung, or spectrographic monitor, developed in conjunction with the A.E.R.E., Harwell; a "loud-to-loud" telephone of revolutionary design for two-wire communication, now being used by several leading telecommunication firms; photographic flash equipment (including what is claimed to be the world's only guaranteed constant-colour temperature equipment); and various voltage-stabilizers and battery chargers. The items described below, however, are the most notable developments from the aeronautical viewpoint.

*Sequential Image Convertor SP.2.*—Hailed as "the fastest camera in the world," this instrument provides a means of recording a sequence of events taking place at extremely short intervals of time and/or a series of distinct positions of objects moving at very high speed. Typical applications might be projectile motions or the detonation of high explosives. Although the equipment was mainly intended for observation of single transient phenomena, very fast repetitive actions may also be observed stroboscopically.

An image convertor is basically a cathode-ray tube fitted with a photo-cathode (instead of a heated filament) upon which is focused an optical image. The light distribution of this image is thereby converted into an exactly similar distribution of emitted electrons, which are focused and accelerated, and finally strike a luminescent screen where an exact reproduction of the original is obtained. The tube may be cut off by the action of the grid and only turned "on" for a length of time as short as 0.01 $\mu$ sec by applying a suitable grid pulse.

Further, the electron beam can be magnetically deflected so that a small square picture can be deflected into several distinct positions while the grid is itself pulsed. This form of staircase deflection results in the fluorescent screen receiving six pictures, each 2 cm square, which persist long enough for them to be photographed. The shutter pulse speed can be varied between 0.1 $\mu$ sec to 10 $\mu$ sec, and the frame rates are five times as long, i.e., from 2 megacycles to 20 kilocycles; between these limits seven speeds can be selected.

The field optical system consists of three separate Gregorian telescope concave-mirror assemblies. The respective focal lengths and apertures are F = 3in at f/1.5, 6in at 2.4 and 12in at 5. The camera has a recording lens of F = 3.3in at f/1.2, and the film is in the form of 4in by 5in slides.

The light loss is no greater than about two stops, although, of course, the object being photographed must be intensely illuminated or self-illuminating. At speeds faster than 1 $\mu$ sec the complete system has a resolution better than 60 lines per cm, and up to 200 lines per cm is possible at slower speeds. It is also to be noted that the equipment can "look" at any part of the electro-magnetic spectrum, and is not restricted to visible light.

It is thought that this equipment may represent the ultimate in high-speed photography for, although faster timing is possible, this could be achieved only by improving the mechanical method by which each new negative is positioned for the succeeding six-frame exposure. This would involve a considerable increase in cost. The present maximum rate of picture-taking is two million frames per second; this does not, of course, mean that 2,000,000 frames can be exposed in one second.

A Winston Electronics SP.2 is now awaiting shipment to the U.S.A., against a special requirement for rocket research.

*Spectrum Analyzer.*—This is a laboratory-test unit for examining the power, band-width and frequency of microwaves. It can be readily converted for use in the X, S, L and (shortly) Q bands, and is one of the most flexible and competitive equipments of its type.

*Vibration-test Control.*—Developed to provide automatic control of a vibration-test machine, this device enables any given item to be tested against the appropriate official specified vibration requirement.

The equipment can control over a frequency range from 6 to 5,000 cycles per second, over an acceleration range from zero to 20 g. The frequency can be manually set, or can sweep from 10 to 2,000 cycles at a constant time per octave. The frequency can be held at any value required.

The equipment can be set, within the specified limits, to carry out any desired variation of frequency, amplitude, velocity or acceleration, according to the requirements to be met by the part under test. A stroboscopic lamp can also be connected into the apparatus.

*Alternator Test Set.*—This equipment combines the functions of a number of units into a neat pack containing four independent, accessible portions. The set can test every phase of the performance of a turbo-alternator set, the results being plotted graphically by a multi-pen Kelvin Hughes recorder. The circuitry can readily be adjusted to any frequency.

*Rectifier Sets.*—As a typical example, the "Constavolt" Type B is an extremely versatile unit, and it contains no hot cathode or moving parts, control being effected by a transductor and magnetic amplifier. It can accept single- or three-phase input power with a magnitude of a few watts or many kilowatts, and provides automatic stability against changes in load, supply voltage and supply frequency. Little heat is generated, radio interference is zero and the whole equipment is compact and robust.

*Guided-weapon Testing.*—For obvious reasons, very little can be said of the company's work in this sphere. It can, however, be disclosed that Winston Electronics have developed, and are delivering, complete installations capable of carrying out complete pre-launch functional testing of the most complex forms of guided missile.

The pre-launch test equipment consists mainly of a large control desk, housing a great deal of equipment in controlled-atmosphere cabinets. From this installation, an "umbilical cord" is led to the missile on its launching stand, and the multiple wires in the appropriately named cable carry "life" into the missile. After testing the behaviour of all the individual circuits, the equipment simulates a target and checks the tracking of the missile while this "target" is "moved" rapidly to various ranges and bearings.

*Metal Flaw Detection.*—Another preliminary note of a new development can be published: it concerns the use of controlled eddy currents induced in a metal specimen for the examination of cracks or porosity at or near the surface. A probe is used to examine the nature of the induced currents, and an indication can be provided of the number, shape and size of intrusions down to a length or width of 0.001in.

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## PROBLEMS OF MANAGEMENT

FOR the past six years, the Engineering Department of Cambridge University has invited senior staff of various engineering firms to prepare and deliver lectures on their activities and management problems. In the Michaelmas Term of 1953 seven such lectures were given by executives of the United Steel Companies, Ltd., and these have now been printed by the group as a special booklet.

The seven papers are: *The Role of the Directing Authority in a large Company*, by G. Steel, J.P. (managing director, United Steel Companies); *Production Management in an Integrated Iron and Steel Works*, by Lt-Cdr. G. W. Wells, R.N. (Retd.), (general manager, Appleby-Frodingham Steel Company); *Administrative Controls in Management*, by R. Peddie, B.A. (secretary, United Steel Companies); *Duties and Problems of the Chief Engineer in a Large Works Manufacturing Special Steels*, by C. M. Slocombe (chief engineer, Samuel Fox and Co.); *Organization and Application of Scientific Research in Industry*, by J. H. Chesters, D.Sc. (Tech.), (assistant director of research, United Steel Companies); *Planned Development: Planning a Large Steel Works*, by K. Paterson, B.Sc. (Eng.), (chief mechanical and civil engineer, Appleby-Frodingham Steel Company); and *Staffing a Steel Works; Problems in Training—from the Apprentice to the Manager*, by D. R. O. Thomas, M.A., (chief education officer, United Steel Companies).

# The LION ... the latest and greatest ACTUATOR by Plessey

| | |
|---|---|
| Working load . . normal 2,000 lbs., max. 2,500 lbs. | |
| Static load | 10,000 lbs. |
| Stroke | 4 inches |
| Time for 4-inch stroke | 10 secs. |
| Rating | 1½ minutes |
| Weight | 15¼ lbs. |
| Working Voltage | 92/115 volts D.C. |

PUMPS • VALVES • CARTRIDGE STARTERS • PRE-FORMED WIRING SYSTEMS • ELECTRIC ACTUATORS

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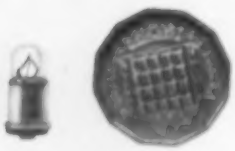
# space & weight saving

# IN EQUIPMENT DESIGN



**ATLAS MIDGET PANEL BULB** Overall length: 14.6 mm. Bulb diameter: 6.3 mm. Rating: 28v., 1 watt 0.04 amp. Also available in 12v., 6v., R.A.E. and S.R.D.E. type approval. Flanged cap and single centre contact for easy replacement.

The need for saving space and weight in modern electronic and panel control equipment is an ever present problem. The Atlas Midget panel bulb was designed with these difficulties particularly in mind. Tiny in size, simply and robustly constructed, its success is confirmed by type approval from the R.A.E., Farnborough, and S.R.D.E., Christchurch.

The development of the Atlas Midget panel bulb made possible the production of the Thorn Miniature Sealed Panel Lampholder, which has been developed specifically for the Armed Services. It is available with dimmer or indicator cap, and will withstand conditions of constant vibration and shock.

Brief details are given below, but further enquiries are invited.

DIMMER TYPE INDICATOR TYPE

**THORN MINIATURE SEALED PANEL LAMP HOLDERS** Overall length including contacts: 1.43" Dia.: .75". Weights: with Indicator Cap 0.276 ozs., with Dimmer Cap 0.644 ozs. Conform to Radio Components Specs. (Prov.) 201, Humidity Class, H.1. Temperature category 40/100 (-40°C. to + 100°C.), Pressure sealed to 20 lbs./square inch.

Completely weatherproof and will withstand conditions of constant vibration and shock. Rotation of the dimmer cap controls the light output from bright to dim by means of an internal metal shutter. Developed originally for A.F.V.'s, Thorn Miniature Sealed Lampholders have many other obvious applications.

The holders are insulated from the panel which can vary from $\frac{1}{16}$" to $\frac{1}{4}$" thick. Thicker panels may be counterbored. Single hole mounting facilitates fitting. Rotation is prevented by flats on the body. The lamp can be replaced without breaking seals by unscrewing cap.

**THORN PASSENGER CALL BUTTON** for passenger-carrying aircraft. Length: $2\frac{1}{2}$" overall. Dia.: $\frac{3}{4}$". Weight: $\frac{3}{4}$ oz. including 28v. Atlas Midget panel lamp. Single hole fixing to panels up to $\frac{1}{16}$" thick. Supplied in two types, either solder or terminal terminations.

In its normal position, the translucent button is not illuminated: but on being pressed it operates a buzzer in the steward's pantry, lights up and remains so until extinguished by resetting. Lamps are replaced from the front by unscrewing the translucent button.

Thorn

## THORN ELECTRICAL INDUSTRIES LTD

AIRCRAFT COMPONENTS DIVISION, 105-109 JUDD STREET, LONDON, W.C.1

# CIVIL AVIATION

## DC-4s FOR AIR CHARTER

THE managing director of Air Charter, Ltd., Mr. F. A. Laker, recently announced his company's intention of buying three DC-4s from America. The first aircraft is due for delivery on January 25th, and purchase of the others is under negotiation. Treasury approval was given for Air Charter to buy the aircraft for dollars, and an import licence was granted by the Board of Trade.

The company's application for approval of its plan to buy DC-4s referred to the difficulty of obtaining new equipment in Britain, and to its success as an earner of overseas currency. Air Charter are at present operating seven Yorks, five Tudors and three Bristol 170s. The company will probably reduce the size of its York fleet which is now employed mainly on trooping work, though Mr. Laker does not expect the DC-4s to be employed as troopers. Air Charter's new aircraft will be 68-seat ..g.i-density versions with provision for quick conversion into fre.ghters.

## ATLANTIC FREIGHT INCREASE

DURING 1954 Seaboard and Western Airlines flew more than twice as many cargo ton-miles on the North Atlantic as in the preceding year. The company, which still awaits C.A.B. approval to operate a scheduled North Atlantic freight service, now has a fleet of four Super Constellation freighters and five DC-4s. Its Super Constellations, which are the largest long-range commercial freighters in use, were introduced only recently, and the company looks forward to an impressive further expansion of traffic in 1955.

## K.L.M. VETERANS' RETIREMENT

ON January 1st K.L.M. announced the retirement of two of their best known captains—J. J. Moll and G. van Messel. Captain Moll, who is 54, will be remembered as co-pilot of the K.L.M. DC-2 which won the handicap section of the 1934 Melbourne Air Race. He was the first of the company's pilots to be appointed Commodore, a distinction awarded a year ago in recognition of his long service to civil aviation. Capt. Moll, who has flown 18,000 hours, served with B.O.A.C. for part of the war.

Capt. van Messel, who is 52, joined K.N.I.L.M. in 1930 and commanded the group of K.N.I.L.M. aircraft which were flown from the Netherlands East Indies to Australia in 1942 to escape the Japanese invasion. In 1947 he was appointed flight superintendent of K.L.M.'s Eastern and Australasian routes.

## T.A.A. PROFIT LAST YEAR

IN their annual report for the year ending June 30th, 1954, Trans-Australia Airlines record an unbroken safety record for the eighth successive year. The airline, which is State-owned, made a profit of £A114,410 during the period reviewed, some £A20,000 less than the profit for the preceding financial year.

At the end of the 1953-54 period T.A.A. had a fleet strength of 40 aircraft—five Convairs, four DC-4s, 24 DC-3s (including four Dakota freighters), four Drovers and three Dragons. This fleet is now being supplemented by seven Viscounts. The report notes "that the airlines of the world are still awaiting a modern aircraft to replace the DC-3 . . . the replacement should accommodate 20 to 30 people, be at least 100 m.p.h. faster and, for Australian conditions, be pressurized." It also expresses the hope that a helicopter capable of meeting Australian needs will become available, but observes that there are less than three million inhabitants within a 200-mile radius of either Sydney or Melbourne compared with 72m within this radius of Brussels.

No significant traffic trends are evident in the T.A.A. report. The number of passengers carried on scheduled services (656,000) was only 10,000 more than in the preceding financial year; freight ton-miles increased by 14.5 per cent but mail traffic showed a slight decrease. Total hours flown by the company's aircraft dropped from 100,000 to 95,000; even so, this indicates high utilization for a fleet of 40 aircraft, including a number of small machines. The T.A.A. report states that the average passenger load-factor for the year (70.8 per cent) exceeded that of any other Australian domestic operator.

## INQUIRY INTO PRESTWICK ACCIDENT

THE Ministry of Transport and Civil Aviation announced this week that a public inquiry will be held into the accident to B.O.A.C. Stratocruiser G-ALSA *Cathay* at Prestwick Airport on Christmas Day. Arrangements for the inquiry, which is to be held in Scotland, will be announced shortly.

The aircraft, completing the first stage of a scheduled flight from London to New York, overturned on landing at Prestwick and caught fire. Of the 36 people aboard, 28 lost their lives; seven of the eight survivors were members of the flight crew. The Stratocruiser was commanded by Capt. W. L. Stewart, a senior B.O.A.C. pilot with over 300 transatlantic crossings to his credit.

The accident followed a ground-controlled approach in the early hours of the morning under weather condit ons reported as: cloud base, 700ft; visibility, 2½ miles; drizzle. Accident investigators were reported to be considering a theory that after the aircraft had undershot the runway the port undercarriage collapsed, severing fuel lines in the wing. Impressions were found in damp ground some 200 yards short of the threshold to the main runway, and a trail of wing fragments led to the wreckage of the aircraft at the side of the runway.

## MORE FERRY FARE CUTS

FOR the eighth time in seven years Silver City Airways have reduced fares on their cross-Channel ferry services. Reductions in car charges on the Ferryfield to Le Touquet route will range from 30s to 50s return, and motor cycle owners will pay up to 25s less for solo machines. Bicycle fares on the same route have been reduced from 10s to 5s return. Passenger fares are unaltered.

## B.E.A. AND THE UNIONS

AT a meeting held on December 31st the trades union representatives on the National Joint Council for Civil Air Transport passed a resolution criticizing B.E.A.'s action in summarily dismissing the maintenance engineers who took part in an unauthorized mass meeting on December 17th.

Altogether 315 men were dismissed, but eight appealed on the grounds that they had not in fact attended the meeting and their appeals were accepted. Subsequently, 306 employees were re-engaged by B.E.A. after signing an undertaking to refrain from any unconstitutional action. The only man not re-engaged was Mr. J. Peters, the shop steward who was at the centre of the dispute. After the announcement of his dismissal for "grave industrial misconduct" Mr. Peters stated that he would appeal against B.E.A.'s decision.

Lord Douglas of Kirtleside, chairman of B.E.A., and Mr. Peter Masefield, chief executive, issued a statement on December 31st refuting the union criticism, but after further discussions on January 3rd the Corporation agreed to withdraw the document signed by the re-engaged men.

*This Viking, G-AHOR, was recently converted into a passenger/freighter for Airwork by Eagle Aircraft Services at Blackbushe; similar conversion is planned for two more Airwork Vikings. This Eagle-evolved method of increasing the Viking's versatility was first applied to an Arab Legion Air Force machine, and Eagle subsequently converted one of their own fleet. Now receiving the same treatment is G-AJCE, an ex-B.E.A. Viking for Svensko Aero of Sweden.*

## CIVIL AVIATION . .

*Operation of Herons by B.E.A., which will begin next month, was foreshadowed by the appearance of G-ALZL in B.E.A. livery three years ago. This aircraft, de Havilland's Series I demonstrator, is shown in company with a Dove. The B.E.A. Herons will be registered G-ANXA and G-ANXB.*

### PROJECTED BREGUETS

THE Breguet company is reported to be working on two new transports designated the 766 and 767. The former is said to be a 60-ton airliner which, with four turboprops of British manufacture, will be capable of carrying 150 passengers for 2,175 miles or 100 passengers from Paris to New York direct. The Breguet 767, with British turboprops or by-pass turbojets, is described as an 80-ton airliner carrying up to 130 passengers from Paris to New York non-stop.

### HUREL-DUBOIS DEVELOPMENTS

AMERICAN sources say that a United States or Canadian licensee is being sought for the Hurel-Dubois H.D.32. The company's general sales manager, M. E. J. Escande, is quoted as saying that the licence fee would be nominal. While aircraft could be made available from French production, he considered that North American operators would prefer to buy locally built aircraft.

It is also stated that a stretched-fuselage version of the H.D.32 will fly next month, and that the H.D.70, with Darts, will be flying next year. One of the two existing prototypes (the first H.D.32 and the lower-powered H.D.31) is due to fly to Brazzaville this month for hot-weather trials. Flying time logged by these two aircraft now exceeds 600 hours.

Current price of the H.D.32 fully equipped is stated to be £160,000. Orders are said to total 150 aircraft, customers being Air France, the French Navy and other French operators, and two airlines outside France.

### FRIENDSHIP FINANCES

THE subsidy paid by the Netherlands Government towards the design and development of the Fokker F.27 Friendship and for construction of two prototypes is reported to be about £1,500,000. In addition to the two flying prototypes, the wings and fuselage of a third aircraft are being constructed for tests.

The possibilities of Friendship production by the Fairchild company in America are still being discussed, and Fokker also hope that their new factory in Brazil will build Friendships. The Dutch company recently said that it would have to build 50 or 60 aircraft before showing a profit. For Fairchild, however, the break-even number is said to be at least 200, due to higher labour costs.

It is reported from Holland that the first prototype of the Friendship, due to fly this summer, will display a large dorsal fin.

### COAST-TO-COAST AIR COACH

EYEBROWS were raised in U.S. airline circles last month when an enterprising "non-sked," North American Airlines, inaugurated daily air-coach services between Los Angeles and New York. The company began operations with the first of two DC-6Bs bought from Douglas. The aircraft carries 102 passengers at a one-way fare of $88, compared with the $99 charged by the big certificated carriers, who offer less cramped accommodation in DC-7s and Super Constellations.

North American's schedule for the eastbound flight, made overnight with one stop, is about 9½hr. Westbound flights are scheduled to take 7 hr 55 min non-stop, but this is an unrealistic estimate made in deference to the U.S. air regulation which forbids non-stop domestic flights of over 8 hr duration. The inaugural flight from Los Angeles to Burbank took nearly 9½ hr.

This regulation was recently waived to permit continuance of non-stop trans-continental services by American Airlines, and North American have applied to the C.A.B. for similar exemption.

American Airlines announced on December 27th that they had requested C.A.B. "not to take any action that would aid or abet the non-scheduled air carrier 'North American Airlines' in further violations of the law." The statement added that, in earlier proceedings, the C.A.B. had found the airline's use of the name North American Airlines to be "an unfair and deceptive practice and an unfair method of competition."

### AIRLINE TRAFFIC LAST YEAR

STATISTICS showing the total traffic results in 1954 of all scheduled air services (Russian and Communist Chinese excepted) were released last week by the International Civil Aviation Organization. The I.C.A.O. figures, which are presented in tabular form on the page opposite, show that scheduled air transport continued to expand—but that the average post-war rate of expansion was not maintained.

The total number of passengers carried rose by 11 per cent to 57.8m, and the number of passenger-miles flown increased in proportion. Aircraft miles flown went up by only 4 per cent, from which it may be inferred that increased aircraft capacity, rather than additional service frequency, was largely responsible for the extra traffic. This added capacity resulted mainly from the further spread of tourist services, with consequent increase in seating densities—as shown by the fact that the "average" airliner carried 7 per cent more passengers than in 1953. The introduction of newer, larger aircraft made a less significant contribution to this trend. There was practically no change in the average distance per passenger (554 miles), indicating that extra traffic

*The clover-leaf cowling over this Alvis Leonides Major engine in the H.P.R.5 flying test-bed (formerly the Mamba-Marathon) is an easy-maintenance feature of the forthcoming Handley Page Herald, the first prototype of which will fly this year. Nominal power rating of the Leonides Major is 870 h.p.*

*Acapulco, Mexico, is the setting of this new line in airport architecture. The airport is located one hour by Convair from Mexico City; Aeronaves de Mexico provide four connecting services daily.*

was evenly shared between long-haul and short-haul operators.

Mail traffic increased by an encouraging 16 per cent, but air-freighting results were disappointing: cargo ton-miles flown went up by only 3 per cent. This may be partly accounted for by the fact that high-density tourist aircraft offer less cargo space—and most air cargo is still carried as make-weight on passenger services. The future of all-freight services continues to depend on the availability of suitable freight aircraft for both long and short distances.

The lion's share of all scheduled air traffic went to the 71 member airlines of the International Air Transport Association, operating a total fleet of some 2,500 aircraft. An I.A.T.A. statement last week said that these companies earned "close on $2,000,000,000" revenue last year, 10 per cent more than in 1953. Traffic results for all I.A.T.A. airlines in 1954 were as follows:

| | |
|---|---|
| Passengers carried | 44m (10 per cent increase) |
| Passenger-miles flown | 28,000m |
| Cargo ton-miles flown | 527.4m (4 per cent increase) |
| Mail ton-miles flown | 199m (14 per cent increase) |

According to the I.A.T.A. statement 1954 was the first year in which more passengers travelled by air across the oceans of the world than by sea. The number of sea passengers between Europe and North America is not yet known, though it is probable that on this route shipping companies continue to carry slightly more than half the total passenger traffic. Nevertheless, the figures for North Atlantic air travel are most impressive: during 1954 the 12 I.A.T.A. airlines on this route carried 580,000 passengers, 7,200 tons of mail and 12,000 tons of cargo on 15,000 flights—"an average of one transatlantic air connection virtually every half hour, day and night, every day of the year."

Though healthy in other respects, I.A.T.A. airlines' results are not regarded as satisfactory from a financial viewpoint. Sir William Hildred, director-general of I.A.T.A., estimates that the profit margin, on a global basis, is little more than one per cent. The airlines, he points out, are thus extremely vulnerable to the effects of even slight recessions in trade or travel, increases in operating costs or added governmental taxes or charges.

In addition to the total traffic figures issued by I.C.A.O. and I.A.T.A., some individual airlines have released provisional statistics of their operations during 1954.

B.E.A. broke all their previous records, carrying 1,825,000 passengers, compared with 1,630,000 in 1953. T.C.A. carried 1,429,000 passengers, 9 per cent more than in 1953, and flew 12 per cent more passenger-miles. K.L.M. carried 681,000 passengers—a 14 per cent increase—of whom 434,000 flew on tourist services, the proportion of tourist to first-class passengers being 53 per cent higher in 1954 than in the previous year.

**SCHEDULED AIR TRAFFIC IN 1954—I.C.A.O. STATISTICS**

| | Miles flown | Pass. | Pass. miles | Cargo ton-miles | Mail ton-miles | Av. No. pass. per a/c. | Av. miles per pass. |
|---|---|---|---|---|---|---|---|
| | | | (millions) | | | | |
| 1954 | 1,206 | 57.8 | 32,000 | 716 | 217 | 26.5 | 554 |
| 1953 | 1,156 | 52.0 | 28,580 | 696 | 188 | 24.7 | 551 |
| 1952 | 1,059 | 45.0 | 24,540 | 668 | 175 | 23.2 | 547 |
| 1951 | 976 | 39.9 | 21,380 | 620 | 160 | 21.9 | 536 |
| 1950 | 890 | 31.2 | 16,960 | 518 | 143 | 19.1 | 544 |
| 1949 | 836 | 26.5 | 14,480 | 390 | 128 | 17.3 | 546 |
| 1948 | 789 | 23.5 | 12,990 | 286 | 114 | 16.5 | 552 |
| 1947 | 700 | 21.0 | 11,740 | 187 | 88 | 16.6 | 559 |
| 1946 | 584 | 18.2 | 9,630 | 82 | 67 | 16.5 | 529 |
| 1945 | 373 | 9.3 | 5,100 | 77 | 90 | 13.7 | 548 |
| 1937 | 165 | 2.5 | 880 | n.a. | n.a. | 5.3 | 350 |
| | Percentage Increase or Decrease Between Years | | | | | | |
| 1953-54 | + 4 | + 11 | + 12 | + 3 | + 16 | + 7 | + 1 |
| 1947-54 | + 70 | + 175 | + 172 | + 283 | + 148 | + 60 | + 1 |
| 1952-53 | + 9 | + 16 | + 16 | + 4 | + 7 | + 6 | + 1 |
| 1951-52 | + 9 | + 13 | + 15 | + 8 | + 9 | + 6 | + 2 |
| 1050-51 | + 10 | + 28 | + 26 | + 20 | + 12 | + 15 | + 1 |
| 1949-50 | + 6 | + 18 | + 17 | + 33 | + 12 | + 10 | + 1 |
| 1948-49 | + 6 | + 13 | + 11 | + 36 | + 13 | + 5 | + 1 |
| 1947-48 | + 11 | + 12 | + 11 | + 53 | + 30 | — 1 | — 1 |
| 1946-77 | + 21 | + 15 | + 22 | + 128 | + 31 | + 1 | + 6 |
| 1945-46 | + 57 | + 96 | + 89 | + 6 | + 26 | + 20 | + 3 |

Not included: U.S.S.R. and the People's Republic of China.
n.a.—Not available.

# BREVITIES

A SCHEDULED freight service between London and Frankfurt will be inaugurated by Airwork, Ltd., on January 12th. Thereafter an Airwork Viking or Dakota freighter will leave London Airport for Frankfurt every Thursday at 0100 hr, returning by 0900 hr on the same day.

* * *

Five of Pan American's fleet of ten Convair 240s, which are used mainly in the Caribbean area, have been sold to the Brazilian airline V.A.R.I.G.

* * *

Last October Handley Page announced an order from Queensland Airlines for an unspecified number of Heralds. A New Zealand journal now reports that the number involved is six.

* * *

The annual report of Tasman Empire Airways for the financial year ended March 31st, 1954, shows an operating loss of £146,000. The report states that the ex-B.C.P.A. DC-6s acquired to replace Solent flying-boats on the trans-Tasman service are operating satisfactorily, and that they should show profitable results.

* * *

Formerly passenger agent in London for the Canadian Pacific Railway, Mr. P. K. Reynolds has been appointed sales manager for Canadian Pacific Airlines. He is the first C.P.A. representative to be stationed in London; hitherto the parent company has acted for the airline.

* * *

The Boeing Airplane Co. are reported to have quoted 1958 as the tentative delivery date for first civil versions of the Boeing 707. The cost of one of these aircraft is reported to be £1,500,000, though spares provisioning would increase this amount by a further £350,000.

* * *

The amount of freight handled at United Kingdom airports in October (8,560 tons) showed an increase of 73 per cent on the total for October 1953. Two reasons are given by the M.T.C.A. for this increase: the continued growth of cross-Channel vehicle ferry traffic and the docks strike. The total number of passengers handled in October was 324,000 (11 per cent increase) and the number of aircraft movements (16,700) went up by 7 per cent.

* * *

A loss of some £960,000 was incurred by India's State-owned domestic and regional operator, Indian Airlines Corporation, during the financial year ended July 31st, 1954. The long-haul operator, Air-India International, which is also State-owned, made a profit of about £200,000 over the same period. Compensation of over £2m is being claimed for former shareholders in Air-India International, Ltd.

* * *

The Curtiss-Wright Corporation announces an order from Pan American for a DC-7B flight simulator, permitting crew training to begin in advance of deliveries. Curtiss-Wright built the original Stratocruiser simulator delivered to PanAm in 1948; in addition the company has built or is building simulators for a variety of civil and military aircraft, including the B-52 Convair 340, DC-6B, C-130, B-36, C-124 and Banshee.

* * *

Hire-purchase air travel, which was first introduced by P.A.W.A. only eight months ago, is now being offered by 70 other airlines in the United States alone. B.O.A.C. and B.E.A. followed suit several weeks ago, and the latest European operators to offer deferred-payment air travel are Hunting-Clan Air Transport, Ltd., and K.L.M. On January 1st PanAm extended their "pay later" plan to residents of the United Kingdom, the minimum deposit being 10 per cent with repayment of the balance over periods of up to 21 months.

*Left to right: Sir William Fraser (Baron), Mr. L. Sinclair (Kt. Bachelor), Dr. O. H. Wansbrough-Jones (K.B.E.), Mr. L. Chapman (C.B.E.), G/C. J. B. Veal (C.B.E.).*

# NEW YEAR HONOURS

WITH the notable exception of Rear-Admiral M. S. Slattery, chairman of Short Bros. and Harland, Ltd., the New Year Honours List is a disappointing one so far as the aircraft manufacturing industry is concerned. Admiral Slattery (a photograph of whom appears on page 3) receives a knighthood.

Names of a comparatively few members of companies closely associated with the aircraft industry appear in the list—Sir William Fraser, chairman of the British Petroleum Co., Ltd. (formerly Anglo-Iranian), and Mr. Leonard Sinclair, chairman of Esso, may be mentioned in this connection—but the majority of honours noted below go to members of the ministries. Among them is Dr. O. G. Sutton, Director of the Meteorological Office, who receives a knighthood. As regards honours in the military division of the Honours List, names of some senior R.A.F. recipients are given on the "Service Aviation" pages this week, and further names will appear in that section next week.

### BARON

Sir William Fraser, chairman, British Petroleum Co., Ltd. (formerly Anglo-Iranian Oil Co., Ltd.).

### PRIVY COUNCILLOR

E. N. G. Birch, Minister of Works; Parliamentary Under-Secretary of State for Air, 1951-52.

### KNIGHTS BACHELOR

I. R. Cox, for services as managing director, Metropolitan Vickers Electrical Co., Ltd.; Leonard Sinclair, chairman and managing director, Esso Petroleum Co., Ltd.; Rear-Admiral M. S. Slattery, chairman and managing director, Short Bros. and Harland, Ltd. (portrait—page 3); Dr. O. G. Sutton, Director of the Meteorological Office, Air Ministry.

### ORDER OF THE BATH

#### C.B.

W. R. McGaw, Director-General of Aircraft Production, M.o.S.

### ORDER OF THE BRITISH EMPIRE

#### K.B.E.

Dr. O. H. Wansbrough-Jones, Chief Scientist, Ministry of Supply.

#### C.B.E.

J. Beaumont, Commandant, Technical Training Command, Indian Air Force; C. S. Bryant, lately Director of Materials and Explosives Research and Development, M.o.S.; L. Chapman, managing director, William Jessop and Sons, Ltd.; J. L. Gray, assistant secretary, M.o.S.; F. W. Halliwell, president, Gauge and Tool Makers' Association; Miss Nancy Procter-Gregg, assistant secretary, M.T.C.A.; G/C. J. B. Veal, Director, Aviation Safety and Licensing, M.T.C.A.; A. Watson, Chief Mechanical and Electrical Engineer, Air Ministry; D. J. Williams, civil consultant to R.A.F. in neurology and electro-encephalography.

#### O.B.E.

H. W. L. Absalom, Assistant Director, Meteorological Office, Air Min.; R. J. S. Adair, for services to civil aviation in Australia; S. W. Bainbridge, Principal Information Officer, M.T.C.A.; D. L. Craig, manager, Italy, B.E.A.; A. E. Gollop, Assistant Director of Storage, M.o.S.; A. S. Hartshorn, recently scientific attaché, British Embassy, Paris (now principal scientific officer, R.A.E., Farnborough).

A. T. Horton, principal scientific officer, Min. of Defence; A. I. Llewelyn, Chief Research Officer, H.Q., Bomber Command, R.A.F.; J. Matthews, trade-union-side secretary, National Joint Council for Civil Air Transport; W/C. G. W. Monk, Divisional Air Traffic Control Officer, Scottish Divisional H.Q., M.T.C.A.

G. M. Morant, principal scientific officer, Institute of Aviation Medicine, Farnborough; V. W. M. Roberts, commercial manager, Electronics Department, British Thomson-Houston Co., Ltd.; W. J. Shea, principal, M.T.C.A.; Obs/Capt. I. D. R. Sims, Commandant, Southern Area, R.O.C.; G. Wall, chief experimental officer, Air Min.; W. H. Yoxall, principal inspection officer, Aeronautical Inspection Directorate, Midland Area, M.o.S.

#### M.B.E.

Obs/Cdr. G. A. D. Bourne, Group Commandant, No. 5 Group, Watford, R.O.C.; A. A. Breicha, senior technical officer, Operations Development Unit, B.O.A.C.; G. C. Burch, air traffic control officer II, Northern Divisional Headquarters, M.T.C.A.; J. H. Coney, civil assistant and accountant, No. 14 Maintenance Unit, R.A.F. Carlisle; S. A. Cooper, station engineer, Rome, B.O.A.C.; S/L. H. V. Cox, member of staff of Officers' Association.

H. I. Evans, administration assistant, Shell-Mex and B.P., Ltd.; D. Fairweather, chief of crystal production, Marconi's Wireless Telegraph Co., Ltd.; W. Geary, assistant superintendent, Metropolitan-Vickers Electrical Co., Manchester; H. R. George, lately higher executive officer, M.T.C.A.; E. Goldberg, higher executive officer, M.o.S.; T. W. Greaves, safety officer, Dunlop Rubber Co., Birmingham; Miss Dora Hale, higher executive officer, M.T.C.A.; P. W. B. King, higher executive officer, Air Min.; S. Knight, engineer II, R.A.E., Farnborough; Miss Lilian F. Lewis, experimental officer, Meteorological Office, Air Min.

H. Macpherson, engineer II, R.A.E., M.o.S.; F. Marriott, works manager, Head Wrightson Steel Foundries, Stockton-on-Tees; A. M. Nair, clerk, special class, Air Min. Audit Office, Singapore; I. E. Naughten, superintending inspector, aeronautical inspection service, H.Q. No. 40 Group, R.A.F., H. L. Pace, senior experimental officer, Meteorological Office, Air Min.; H. L. Peddle, signals officer, telecommunications department, M.T.C.A.; S. R. Peek, base engineer, Stratocruiser and Constellation fleet, B.O.A.C.

F. S. Perry, assistant manager, English Steel Corporation, Sheffield; E. W. Phillips, managing director, Air Schools, Ltd., Derby; P. Phillips, civil assistant, Royal Naval Air Repair Yard, Fleetlands, Hampshire; H. J. Ray, higher executive officer, M.T.C.A.; W. J. R. Richards, deputy superintendent, Directorate-General of Works, Air Min.; J. J. Sarche, chief inspector, Ultra Electric, Ltd.; W. T. J. Stead, hon. secretary, No. 148 (Barnsley) Sqn Committee, A.T.C.

### QUEEN'S COMMENDATION FOR VALUABLE SERVICE IN THE AIR

Capt. H. C. Bailey, senior captain (2nd class), B.E.A.; Mrs. Anne Burns, principal scientific officer, R.A.E.; Capt. S. E. J. Jones, senior captain (2nd class), B.E.A.; Capt. I. R. Stephens, captain, B.O.A.C.

### BRITISH EMPIRE MEDAL

W. E. Bevan, chargehand carpenter, No. 47 Maintenance Unit, R.A.F. Hawarden, Cheshire; H. A. Curtis, senior assistant (scientific), Meteorological Office, Air Min.; Obs. J. E. M. Dains, Post 4/L.2, Little Waltham, No. 4 Group, R.O.C.; F. G. Hutchins, chief inspector, Air Min. Constabulary; C. W. Jacobs, chargehand (mechanical) Radar Research Establishment, M.o.S.; H. Neckervis, chargehand instrument maker, R.A.E., Farnborough; Miss Honora O'Brien, telephone supervisor, Grade I, R.A.E., Farnborough; W. L. Peters, stores superintendent, No. 3 Maintenance Unit, R.A.F. Milton, Berkshire; J. Smith, permanent chargeman of fitters (aero), R.N. Air Station, Lee-on-Solent; L. L. Warren, estate bailiff, Halton, Air Min.; F. M. Westley, civilian warrant officer, No. 1563 (Buckingham) Sqn A.T.C.; S. Yoseph, head nurse, Mediterranean Wing, R.A.F. Levies, Iraq.

*Queen's Commendation for Valuable Service in the Air: Capt. H. C. Bailey, Mrs. A. Burns, Capt. S. E. J. Jones, Capt. I. R. Stephens.*

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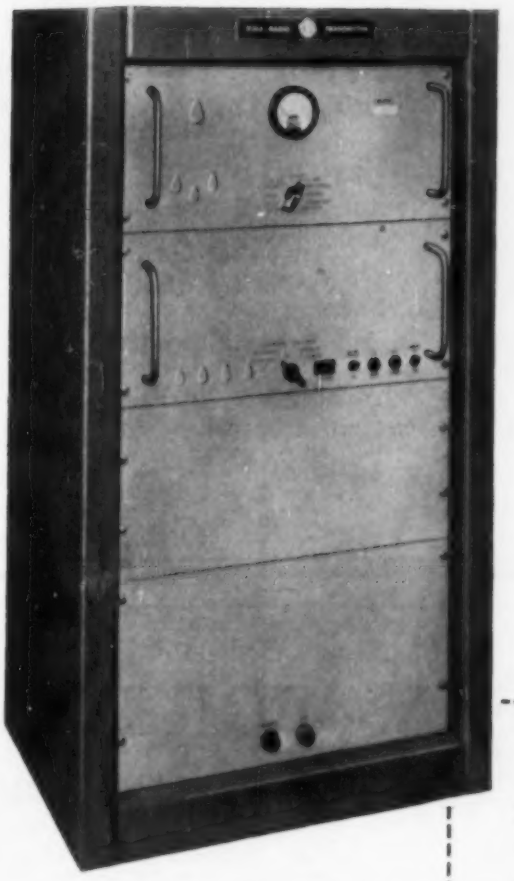

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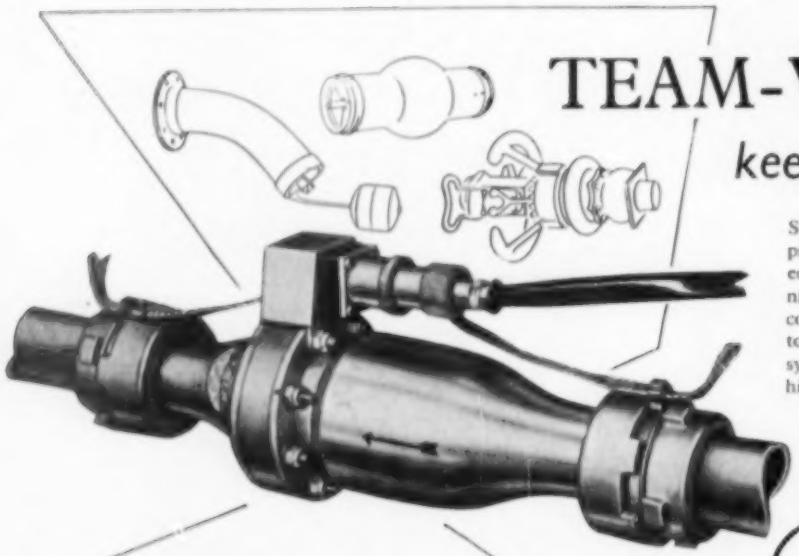

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# SERVICE AVIATION

*Royal Air Force and Fleet Air Arm News*

## New Year Honours

THE names of a large number of officers and airmen of the Royal Air Force appear in the New Year Honours List, published in the *London Gazette*. Air Chief Marshal Sir Arthur P. M. Sanders, Commandant of the Imperial Defence College, is promoted in the Order of the Bath to G.C.B., and Air Marshal Sir Harry Broadhurst, C-in-C. 2nd T.A.F., to K.C.B.

In the Order of the British Empire Air Marshal L. G. Harvey, A.O.C.-in-C. Maintenance Command, becomes a Knight Commander and both Air Commandant N. M. Salmon, Director of the W.R.A.F., and Air Commandant R. M. Whyte, Matron-in-Chief, P.M.R.A.F.N.S., become Dame Commanders.

The complete Service list is as follows (civil Honours are listed on the preceding page.): —

ORDER OF THE BATH (Mil. Div.)

**Knight Grand Cross:** Air Chief Marshal Sir Arthur P. M. Sanders, K.C.B., K.B.E., A.D.C.

**Knight Commander:** Air Marshal Sir Harry Broadhurst, K.B.E., C.B., D.S.O., D.F.C., A.F.C.

**Companions:** A. V-M. C. L. M. Brown, O.B.E., A. V-M. W. G. Cheshire, C.B.E., Act. A. V-M. A. F. Hutton, C.B.E., D.F.C., Act. A. V-M. L. T. Pankhurst, C.B.E., A. Cdre. C. G. Lott, C.B.E., D.S.O., D.F.C., A. Cdre. W. C. Sheen, D.S.O., O.B.E., and Act. A. Cdre. D. R. Evans, C.B.E., D.F.C.,

ORDER OF THE BRITISH EMPIRE (Mil. Div.)

**Dames Commanders:** Air Commandant R. M. Whyte, R.R.C., Q.H.N.S., P.M.R.A.F.N.S., and Air Commandant Nancy Marion Salmon, O.B.E., A.D.C., W.R.A.F.

**Knight Commander:** Act. Air Marshal L. G. Harvey, C.B.

**Commanders:** A. Cdre. M. S. Shapcott, A. Cdre. A. H. Wheeler, O.B.E., G/C. J. B. Altham, G/C. A. L. Derry O.B.E., G/C. A. G. Dudgeon, D.F.C., G/C. M. H. Dwyer, G/C. A. L. Holland, The Rt. Rev. M. P. J. O'Connell, G/C. J. D. T. Revell, G/C. J. M. Thompson, D.S.O., D.F.C., A.F.C., and G/C. C. Turl, O.B.E., D.S.M.

**Officers:** G/C. H. E. Bufton, D.S.O., D.F.C., A.F.C., W/C. F. G. Foot, W/C. A. K. Furse, D.F.C., W/C. C. C. Howes, W/C. J. E. Allen-Jones, W/C. W. N. Kenyon, A.F.C., W/C. R. C. Pearson, W/C. E. F. Pippet, W/C. R. A. Roy, W/C. C. F. N. Seaman, W/C. R. D. Williams, Act. W/C. J. Finch, D.F.C., A.F.C., Act. W/C. J. H. Pool, M.D.B.S., R.A.A.F., S/L. E. C. Bennett, D.F.M., S/L. F. W. M. Jensen, D.F.C., A.F.C., S/L. A. C. Morris, S/L. J. R. Oswald, S/L. S. W. Timmis, S/L. A. L. Walker and Act. S/L. F. Kasz, R.A.F.V.R.

*(To be Continued)*

*The spacious bomb-bay of a Coastal Command Shackleton, from which, in this photograph, mail and supplies have just been dropped to the meteorological ship "Weather Recorder," stationed 300 miles south of Iceland. Each year special efforts are made by Coastal Command aircrews to deliver Christmas and New Year mail to the weather ships.*

## R.A.F. Promotions

IN the half-yearly list of promotions taking effect from January 1st, both Air Marshal F. J. Fressanges, C.B., and Air Marshal T. G. Pike, C.B., C.B.E., D.F.C., are confirmed in their rank. They are C-in-C. Far East Air Force and Deputy Chief of the Air Staff respectively.

Three air vice-marshals also confirmed in rank are: J. G. W. Weston, C.B., O.B.E., A.O.C. No. 90 Group; L. W. C. Bower, C.B., D.S.O., D.F.C. S.A.S.O., Fighter Command; A. F. Hutton, C.B.E., D.F.C., B.A., M.I.Mech.E., S.A.S.O. Technical Training Command.

The following air commodores are promoted to the rank of air vice-marshal: J. Cox, O.B.E., D.F.C., A.O.C. Ceylon; E. M. F. Grundy, O.B.E., S.A.S.O. British Joint Services Mission, Washington; A. D. Selway, C.B., D.F.C., Air Attaché, Paris; A. Earle, C.B.E., Director of Policy (Air Staff); J. C. Neely, C.B.E., D.M., B.Ch., M.R.C.S., L.R.C.P., D.O.M.S., D.O. (Oxon), Q.H.S., Consultant in Ophthalmology, C.M.E.

Group captains promoted to air commodores are: K. J. McIntyre, C.B.E., D. M. T. Macdonald, C.B., H. Eeles, C.B.E., F. A. Pearce, C.B.E., M. W. S. Robinson, C.B.E., W. E. Oulton, C.B.E., D.S.O., D.F.C., R. A. R. Rae, O.B.E., S. C. Widdows, D.F.C., J. Worrall, D.F.C., L. P. Moore, C.B.E., W. D. J. Michie, D. A. Wilson, A.F.C., M.R.C.S., L.R.C.P., D.M.R.E., D.M.R., F.F.R., and L. M. Corbet, C.B.E., M.B., B.S.

The following wing commanders are promoted to the rank of Group Captain: R. E. Drake, O.B.E., A.F.C., W. G. Oldbury, O.B.E., D.F.C., J. E. Innes-Crump, W. I. C. Inness, O.B.E., P. Fleming, O.B.E., K. S. Batchelor, D.F.C., G. V.

*In the Honours List: Air Chief Marshal Sir Arthur Sanders—G.C.B.; Air Marshal Sir Harry Broadhurst—K.C.B.; Air Marshal L. G. Harvey—K.B.E.; Air Commandant N. M. Salmon—D.B.E.; Air Commandant R. M. Whyte—D.B.E.*

## SERVICE AVIATION . . .

Fryer, O.B.E., A.F.C., D. M. Strong, A.F.C., G. R. Magill, O.B.E., D.F.C., J. Woodroffe, D.S.O., D.F.C., C. F. Gray, D.S.O., D.F.C., H. J. Hickey, O.B.E., L. E. Giles, O.B.E., D.F.C., A.F.C., W. V. Crawford-Compton, D.S.O., D.F.C., J. E. Johnson, D.S.O., D.F.C., D. Price, M.A., A.F.R.Ae.S., J. G. Priest, S. G. Morgan, T. E. Burgess, R. A. J. Horne, R. Trippett, E. A. Biddle, I. H. Snelling, A.F.C., A. G. Douglas, M.C., S. R. C. Nelson, O.B.E., M.D., M.C.P. & S., J. B. Wallace, O.B.E., M.D., Ch.B., V. H. Weeks, L.D.S. and E. A. Stockwell, M.A.

*(To be continued)*

### Ceylon Display

ON Sunday, six Vampires from No. 60 Squadron, R.A.F., based at Tengah, Singapore, are due to take part in an air display at Ratmalana airport, Ceylon. Accompanying the fighters are three Valettas of the Far East Transport Wing, carrying servicing and air traffic control staffs. These Valettas will also be used for a parachute demonstration by instructors from the Parachute School at Changi, who flew to Ceylon in three Sunderlands of the Far East Flying Boat Wing which are also taking part in the display.

### Fighter Command Appointment

HAVING, since February 1953, been head of the planning branch of Fighter Command, G/C. P. H. Dunn, C.B.E., D.F.C., A.D.C., has been promoted to the acting rank of air commodore and appointed to the post of Air Commodore in Charge of Operations.

One of A. Cdre. Dunn's wartime appointments was to command No. 274 Squadron, the first Hurricane squadron to operate in the Western Desert. While he was in command, the unit shot down 92 enemy aircraft; his own score was nine destroyed in the air and four on the ground.

### No. 90 Group S.A.S.O.

ON Monday last A. Cdre. H. H. Chapman, C.B.E., A.M.I.E.E., took up his new appointment as Senior Air Staff Officer at H.Q. No. 90 (Signals) Group, Medmenham, Bucks.

A. Cdre. Chapman is a signals specialist and was Director of Signals (Policy) at the Air Ministry before taking the 1954 course at the Imperial Defence College.

*P/O D. J. Noel, winner of the Sash of Merit at the W.R.A.F. Depot, Hawkinge, is congratulated by Mr. H. T. Smith, Assistant Under-Secretary of State for Air (General), who reviewed the recent passing-out parade.*

*Two student navigators, Lt-Col. C. A. North, U.S.A.F., and S/L. J. E. Tipton, D.F.C., and their pilot, W/C W. J. Burnett, D.S.O., D.F.C., who formed one of the R.A.F. Flying College teams taking the Canberra "Aries IV" on Polar flights last month, they took it up to 85 deg N and back in five hours. Details of the flights appeared on page 949 last week.*

### No. 27 Squadron Standard

TODAY, at Scampton, Lincolnshire, No. 27 Squadron is due to receive its Squadron Standard. It is being presented to the unit by A.V-M. A. E. Borton, who was in command when No. 27 first went to France in 1916.

### R.A.A.F. at Darwin

FOLLOWING the building of a new runway last year, a concentration of operational training is to take place at Darwin. Various units, including Citizen Air Force squadrons, will go there for periods ranging from 14 days to two months.

The first arrivals will be the Canberras of No. 2 Squadron, R.A.A.F., and their accompanying aircraft from No. 86 Transport Wing. Early in April No. 2 will be joined by No. 23 (City of Brisbane) Squadron, C.A.F., who will be there on a fortnight's mobility exercise.

From May until July the Lincoln maritime reconnaissance squadron from Townsville will operate, and the Neptune M/R squadron from July to September.

### Cosford Review

THE reviewing officer at the passing-out parade of the 19th Entry of Boy Entrants at Cosford, Staffs, on January 13th, will be Air Chief Marshal Sir Basil E. Embry, K.C.B., K.B.E., D.S.O., D.F.C., A.F.C., Commander of Allied Air Forces Central Europe.

### Williamtown Base

A REPORT from Australia states that the base at Williamtown, N.S.W., will be the first to be used by the R.A.A.F. for supersonic flight training. Aircraft on the station include Sabres, Meteors and Vampires. The Meteors flown by No. 77 Squadron R.A.A.F. in Korea are now being re-assembled after being brought back to Australia by ship.

The first Australian-built Avon-Sabre was delivered to Williamtown from Laverton, Victoria, by W/C. R. C. Cresswell, D.F.C., on December 17th last.

### Aberdeen University Sqdn. C.O.

IN succession to S/L. J. H. Forsythe, D.F.C., who is going to the R.A.F. Staff College, S/L. A. E. Henderson, A.F.C., is taking over command of the Aberdeen University Air Squadron.

S/L. Henderson has been an instructor at Cranwell and was with the Ferry Training Wing at Benson for a year. During the war he served as an instructor and operationally with Coastal Command.

### A-A. Ship to be Launched

ON January 12th next, H.R.H. the Princess Royal is to launch H.M.S. *Lynx* from John Brown's Clydebank shipyard.

*Lynx*, a frigate of 340ft length and 40ft beam, is especially equipped and armed for anti-aircraft defence of the Fleet.

### R.C.A.F. Appointments

TWO Canadian appointments recently announced are those of G/C. J. P. McCarthy, D.F.C., to command R.C.A.F. Station Claresholm, in succession to G/C. W. Hodgson, D.F.C., who has been appointed to the technical staff at R.C.A.F. H.Q. Ottawa.

Both of these officers have served with the R.A.F. G/C. McCarthy completed his first tour of operation while attached as a bomber pilot and G/C. Hodgson transferred to the R.C.A.F. after flying with the R.A.F. the whole of the war.

### Reunions

A REUNION of those who served with No. 458 Squadron, Royal Australian Air Force, will be held in London in February. Further particulars can be obtained from P. W. Pettit, Flat 2, 29 Lexham Gardens, London, W.8.

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## PUBLIC ANNOUNCEMENTS

### AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned application to operate a scheduled air service:—

APPLICATION No. 193/3 from Skyways, Ltd., of 7, Berkeley Street, London, W.1, for the following amendments to their Colonial Coach Service on the route London (Stansted)–Malta–Cyprus (Nicosia) which is at present approved by the Minister of Transport and Civil Aviation for operation without traffic rights between London and Malta with York aircraft at a frequency of one return service per fortnight for the period ending 26th October, 1955:—

(i) Extension of period of approval for 10 years from 26th October, 1955.

(ii) Increase of frequency to one service weekly and at the discretion of the Company to two services weekly during the summer months only.

(iii) Permission to carry up to 10 passengers a week between the United Kingdom and Malta only and to increase this number further in proportion to any additional capacity offered by B.E.A. on their Normal Scheduled Service on the London-Malta route.

(iv) Permission to use Hermes aircraft as from 1st January, 1956.

(v) Permission to use Naples as a technical stop only.

THIS application will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to this application must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3105

## PUBLIC APPOINTMENTS

### FEDERATION OF RHODESIA AND NYASALAND

**Department of Civil Aviation: Vacancies: Inspectors of Aircraft**

APPLICANTS, preferably under 35 (but not over 45) should hold Cats. A, B, and C (or A, C, and D) of the aircraft maintenance engineers licence. (Applicants licensed in A and C only considered if experience specially relevant.) A minimum of 5 years' post-training experience of maintenance, overhaul and repair of airframes and aero engines required.

COMMENCING salary £1,400 on scale rising to £1,550.

APPLICATION forms and further details from the Secretary, Rhodesia House, 429, Strand, London, W.C.2. Completed forms to be returned by January 31. [3081

MINISTRY of Transport and Civil Aviation: Air Traffic Control Officers. Applications are invited from men and women for at least nine Grade III posts. Age at least 23 and under 35 on 1st November, 1954. Essential qualifications are alertness, good personality, physical fitness, tact and balanced judgment. Candidates must have reached the standard of education represented by the pre-1951 School Certificate with matriculation exemption or its equivalent in terms of the G.C.E. or Scottish Leaving Certificate, etc. They must have had experience either as (a) aircrew in civil air transport preferably as pilot or navigator, with considerable experience in the United Kingdom, or (b) pilot or navigator in the Armed Forces, preferably with considerable experience of air traffic control in the United Kingdom. Exceptionally, candidates without aircrew experience will be considered, provided they meet the educational requirements given above, and have had considerable practical experience either in civil aviation or in the Armed Forces of duties directly concerned with the operation of air traffic control. Additional assets will be a general knowledge of civil aviation legislation and practice, and of radio and radar aids to navigation, and a working knowledge of the French language. Air Traffic Control Officers are required to serve anywhere in the United Kingdom, and are liable to tours of duty overseas. Salary ranges from £540 at age 23 to £815 at 30 or over, on entry, rising by annual increments to £1,070 (subject to deductions from £15 to £49 for posts outside the London area). Rates for women somewhat lower. Posts are unestablished, but have long-term possibilities.—Apply to the Ministry of Transport and Civil Aviation, Room 6057, Berkeley Square House, London, W.1, for application forms and further particulars, quoting reference Staffing B1/ATCO. The latest date for receipt of completed applications is 3rd February, 1955. Applications from overseas may be by letter in the first instance, giving date of birth and full details of qualifications and experience. [3093


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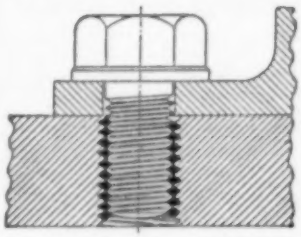

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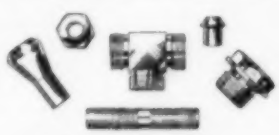

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# INDEX TO ADVERTISERS


| | Page |
|---|---|
| Adcola Products, Ltd. | 26 |
| Air Engine Services (U.S.-U.K.), Ltd. | 27 |
| Alvis, Ltd. | 17 |
| Automatic Coil Winder and Electrical Equipment Co., Ltd. | 6 |
| Avery-Hardoll, Ltd. | 20 |
| Aviation Traders, Ltd. | 31 |
| Blackburn and General Aircraft, Ltd. | 3, 32 |
| Bramah and Co., Ltd., J. R. | 9 |
| Bristol Aeroplane Co., Ltd., The | 28, 29, 31, 32, Cover iv |
| British Institute of Engineering Technology | 29 |
| British Oxygen Co., Ltd. | Cover ii |
| Brooklands Aviation, Ltd. | 31 |
| Carr Fastener Co., Ltd. | 6 |
| Corner & Co., Ltd., G. | Cover iii |
| Cossor Radar, Ltd. | 14 |
| Cross Manufacturing Co. (1938), Ltd. | 29, 31 |
| Curd Components, Ltd. | 29 |
| De Havilland Aircraft Co., Ltd., The | 16 |
| Derby Aviation, Ltd. | 28 |
| Electro-Hydraulics, Ltd. | 11 |
| Fairey Aviation Co., Ltd., The | 15 |
| Ferry Airports, Ltd. | 30 |
| Firth and John Brown, Ltd., Thos. | 7 |
| Flight Refuelling, Ltd. | 24 |
| Folland Aircraft, Ltd. | 19 |
| General Electric Co., Ltd., The | 2 |
| Gloster Aircraft Co., Ltd. | 30 |
| Godfrey and Partners, Ltd., Sir George | 1 |
| Handley Page, Ltd. | 13 |
| Hawker Aircraft, Ltd. | Cover i |
| Hordern-Richmond (Sales), Ltd. | 26 |
| Hunting-Clan Air Transport, Ltd. | 28, 31 |
| Hunting Percival Aircraft, Ltd. | 18 |
| Ilford, Ltd. | 4 |
| Lewis, Ltd., D. | 26 |
| Leytonstone Jig and Tool Co., Ltd. | 6 |
| Lucas (Gas Turbine Equipment), Ltd., Joseph | 12 |
| Marconi's Wireless Telegraph Co., Ltd. | 23 |
| Marshalls Flying School, Ltd. | 32 |
| National Institute of Engineering | 31 |
| Plessey Co., Ltd., The | 21 |
| Power Jacks, Ltd. | 5 |
| Rists Wire and Cables, Ltd. | 8 |
| Robinson and Co. (Gillingham), Ltd., L. | 8 |
| Roe and Co., Ltd., A. V. | 10 |
| Rollason, Ltd., W. A. | 26 |
| Rotax, Ltd. | 24 |
| Scottish Aviation, Ltd. | 25 |
| Siegrist-Orel, Ltd. | 8 |
| Skyways, Ltd. | 28 |
| Teddington Controls, Ltd. | Cover iii |
| Thorn Electrical Industries, Ltd. | 22 |
| Uhlhorn Bros., Ltd. | 32 |
| Vickers-Armstrongs, Ltd. | 29 |
| Whyte and Collins, Ltd. | 28 |
| Wold Associates, William C. | 29 |


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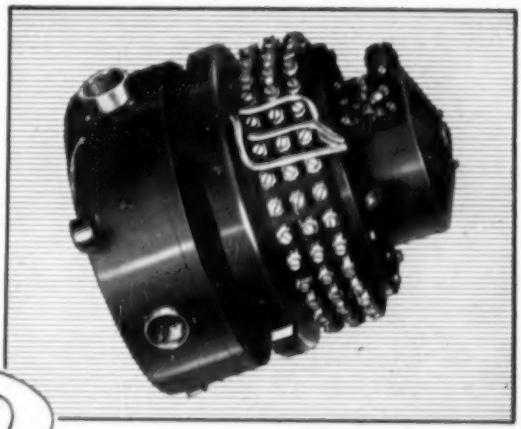

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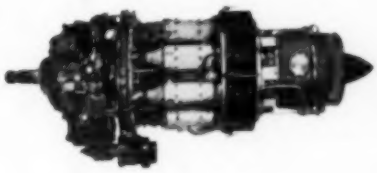

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